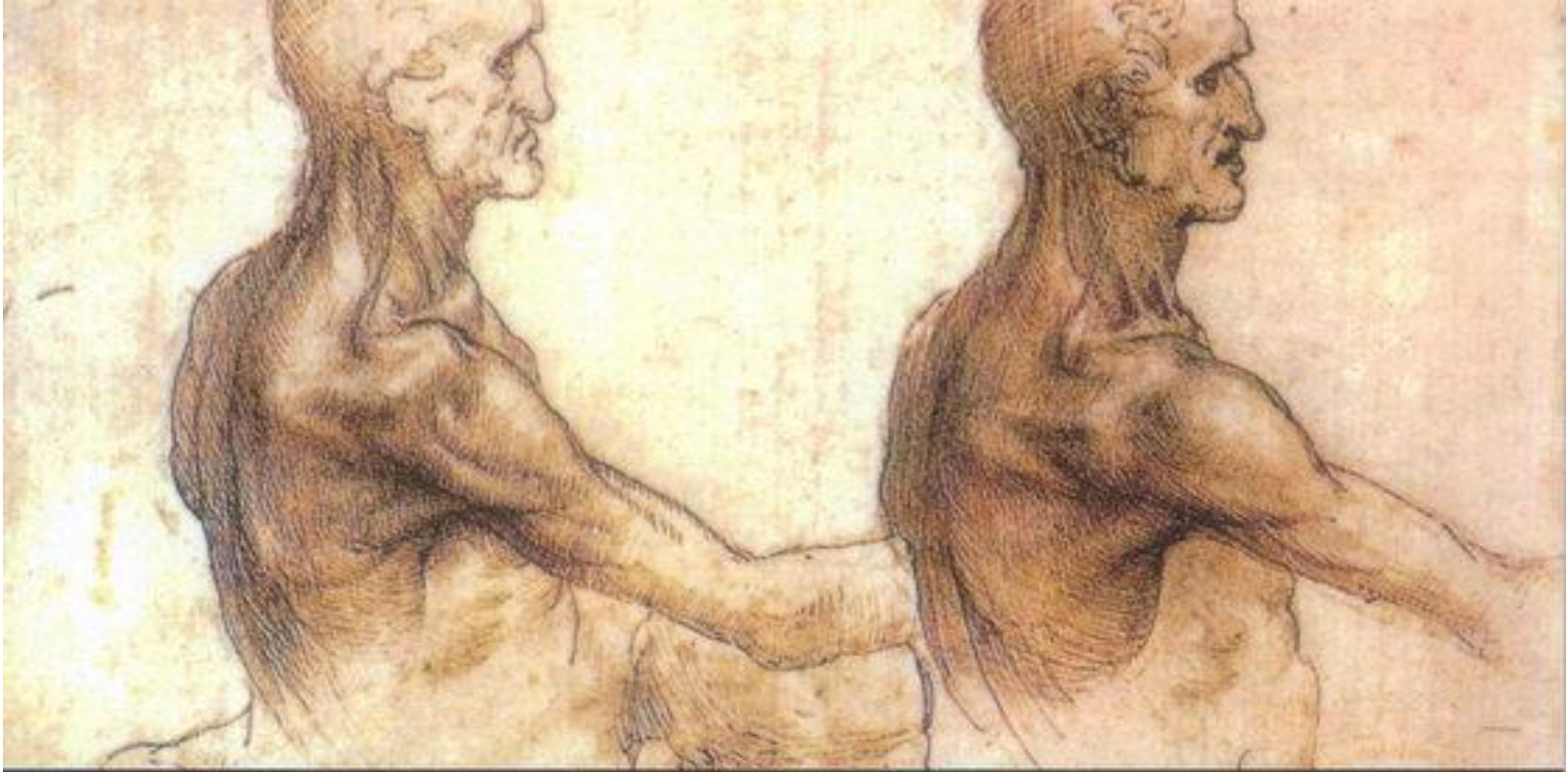
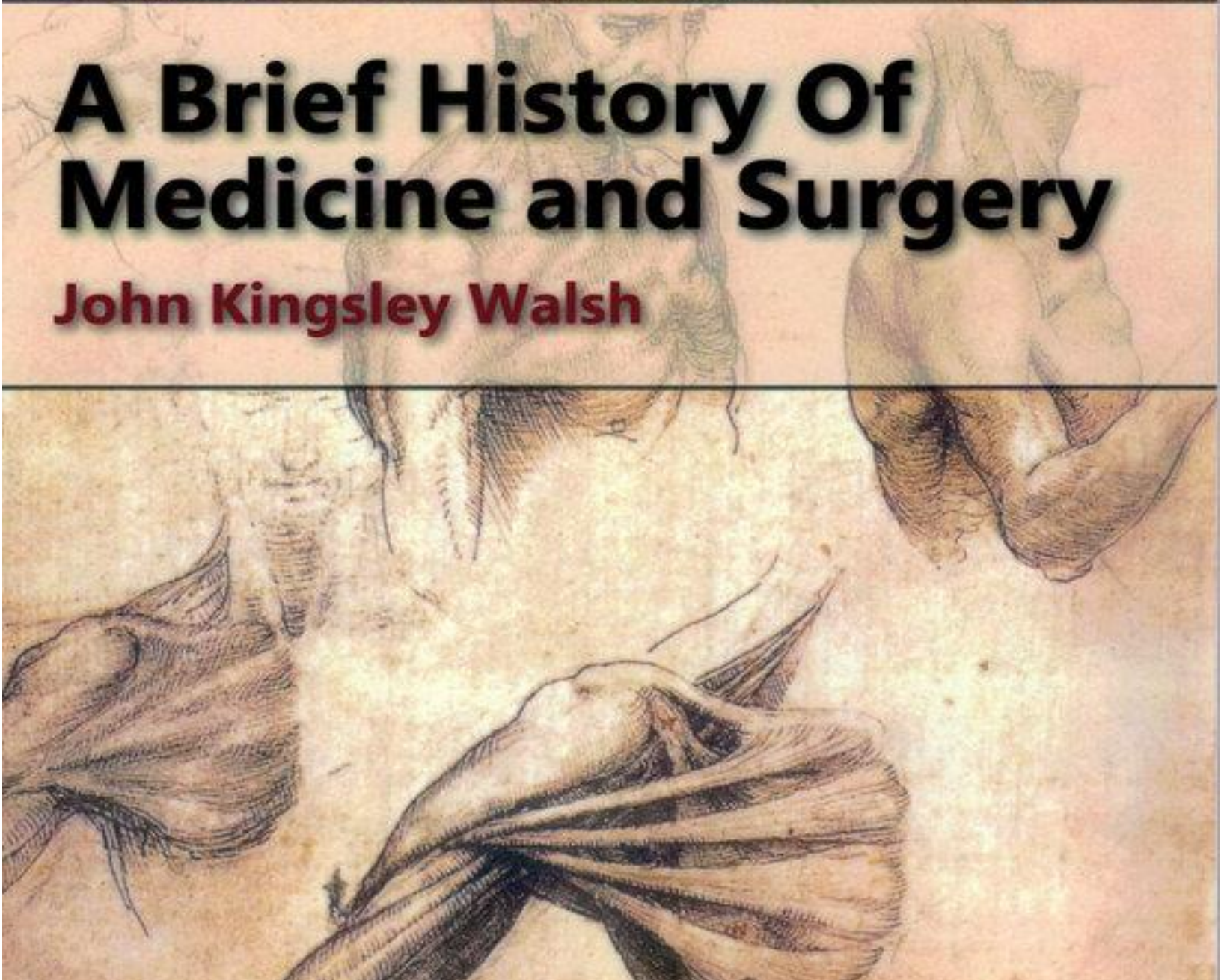




# **A Brief History Of Medicine and Surgery**

**John Kingsley Walsh**



Published by:

John Walsh

1/ 80 Murdoch Street

Cremorne

NSW 2090

Australia

e-mail: johnkwalsh1@gmail.com

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Illustrations:

Front cover: background from Leonardo da Vinci: Anatomical Drawings 1489-1513

Back Cover: Modern surgeons, Barbara Hepworth: Hospital drawings 1947,  
Wounds from warfare, middle ages, 12C picture of ??, Christ healing the sick  
(unknown painter)

Acknowledgements:

My Thanks to Susie Mckenzie of Kwik Kopy Neutral Bay for her help in editing this book and my wife Hilary for proof reading, however, all errors are mine.

Printed by Kwik Kopy Neutral Bay

## **PREFACE**

This book arose out of a talk I gave to my fellow class mates at our 50<sup>th</sup> re-union following graduation as doctors in 1962, and have since given to colleagues.

I realised how much we all owed to our predecessors, as well as our teachers, and hence this book.

I have sourced many references for this book and acknowledge my debt to previous authors. A sample bibliography is attached at the end and I would recommend these books for further study.

There is so much about each individual mentioned, with books written about each of them, that I feel humble just to present a brief overview of their lives. There are many I have missed. My problem was not who to include but, who and what subject to leave out.

It has been impossible to write about every person who has made some contribution to our present good health, for those of us who enjoy it, and to those who are suffering illness or depression for which medicine has yet to provide a cure.

It is sobering to think that in 100 years, we too will be history, whether remembered or not, whatever our achievements.

I dedicate this book to the youth of today, who will discover more and more wonderful things, not just in medicine, but in all walks of life, such that would make our predecessors proud.

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## CHAPTER 1 BIG BANG TO LUCY

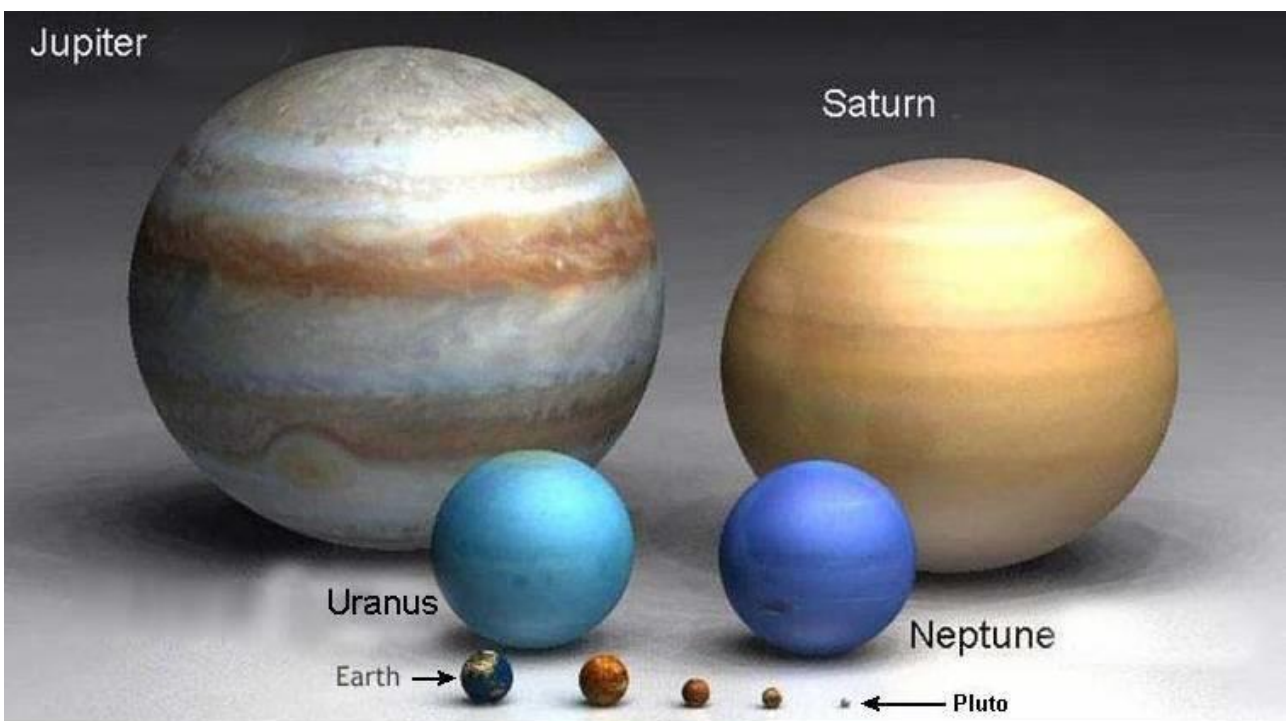
It all began with “The Big Bang”, a term coined by **Sir Fred Hoyle, 1915-2001**, a British astronomer and physicist in the mid-1950s, when he actually believed in a steady state universe instead of, as is now proven, an expanding one. This occurred about 13.5 billion years ago.

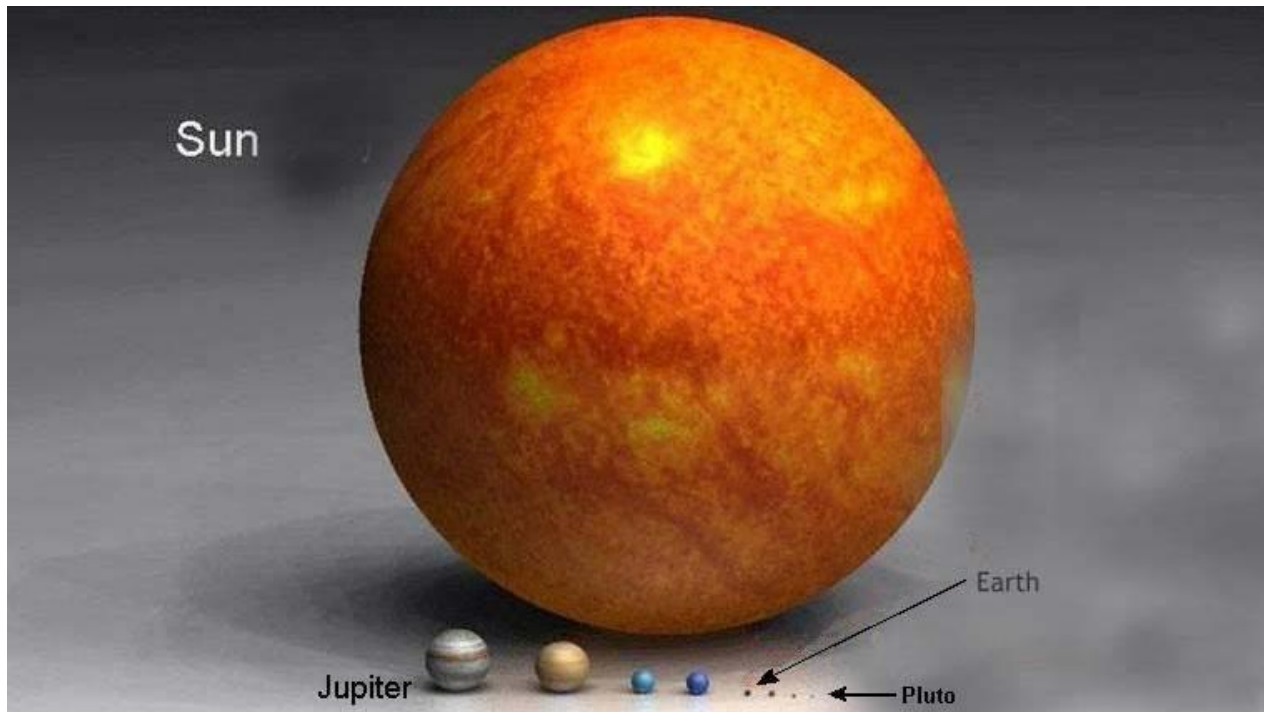
It was he, who first discovered that the majority of the elements of the periodic table are formed in the furnaces of stars, particularly when they explode in a supernova explosion.

The majority of stars are made of hydrogen, the basic element of the universe, which compress this under enormous pressure as they increase in size until nuclear fusion into helium occurs producing huge amounts of energy in the form of heat and light and other radioactivity.

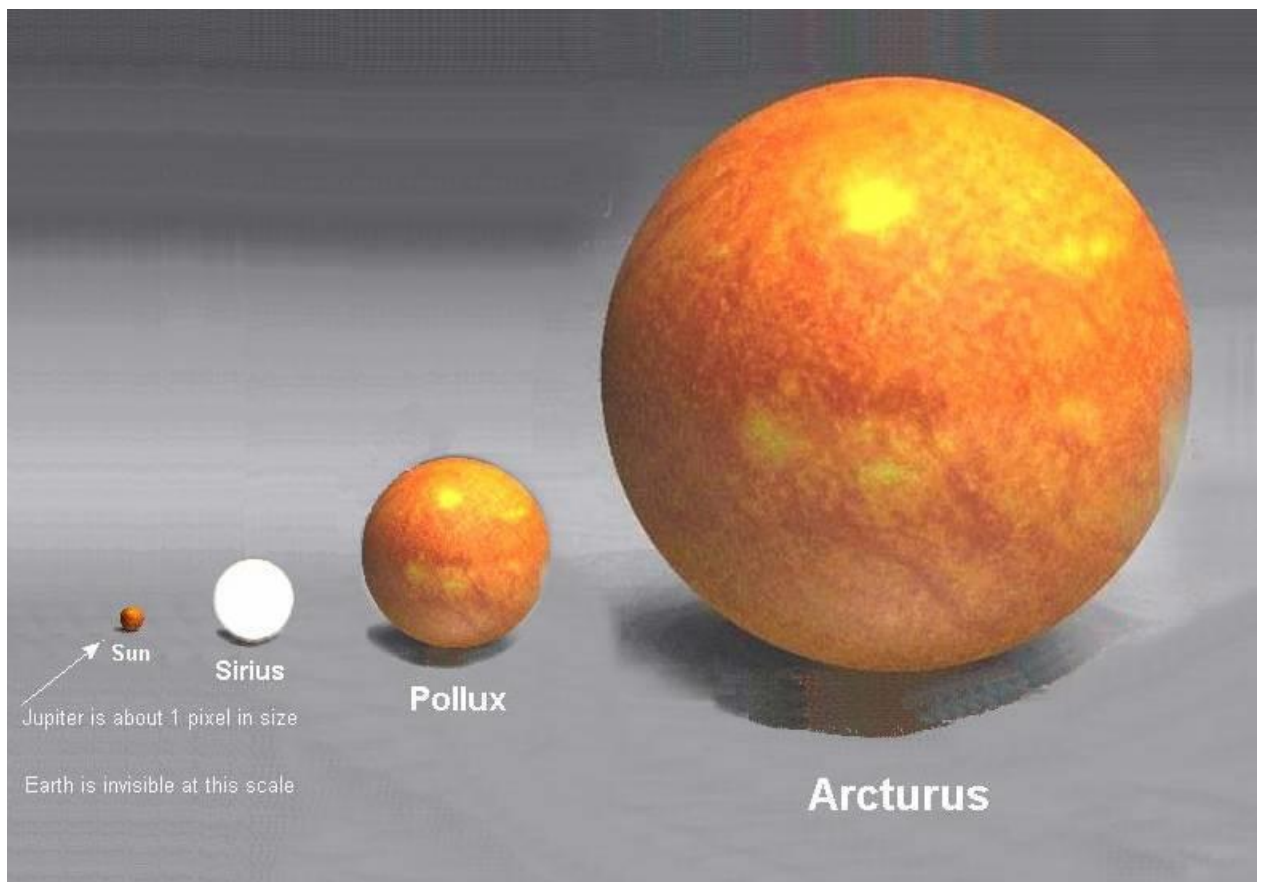
After a supernova explosion, the elements that are formed gradually condense to form planets, which are trapped by a nearby star and a solar system is born.

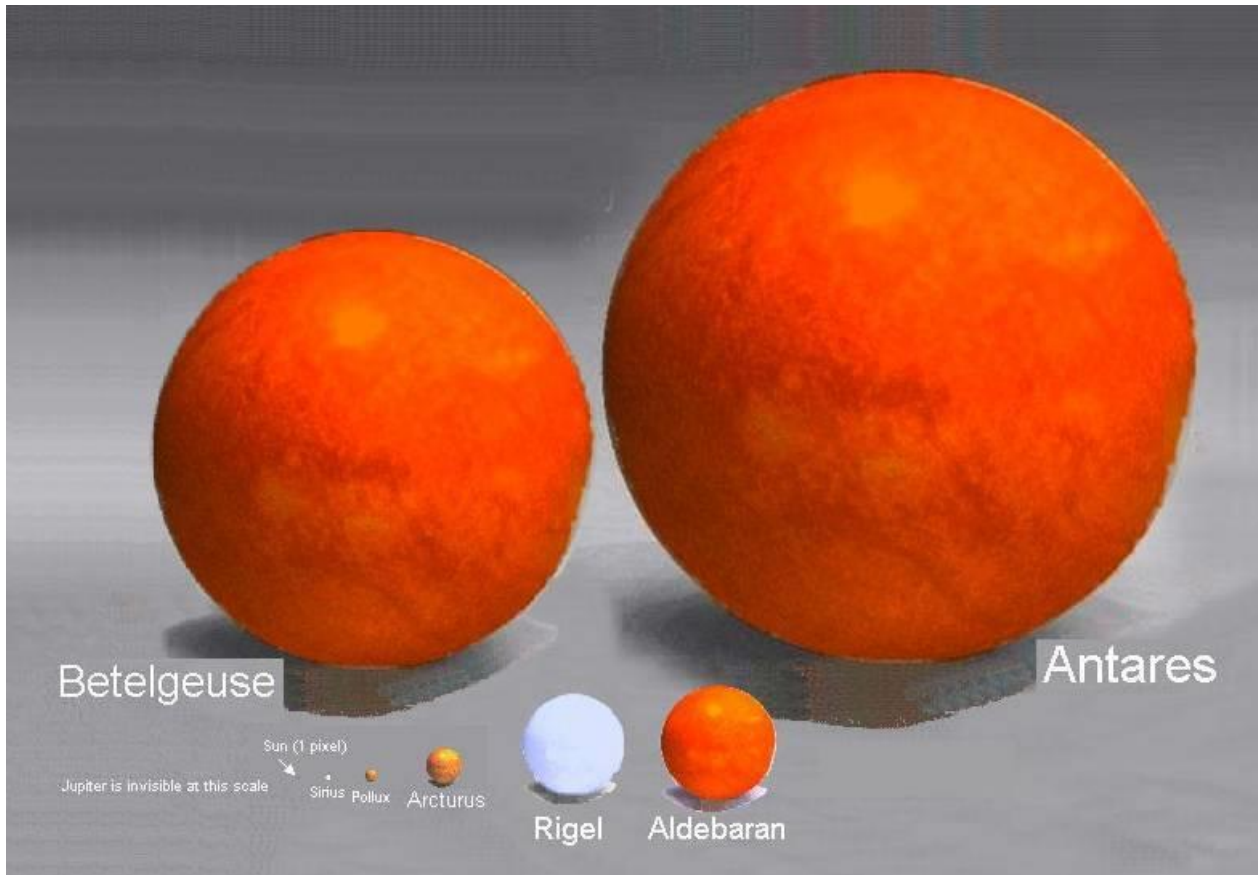
Our system was born 4 billion years ago and has 4 inner rocky planets, and 4 outer gas giants. Pluto was once considered a planet but has been downgraded. It is the furthest away from our star, the sun.





Stars vary in size and ours is relatively small compared to others.





Stars themselves are trapped by the gravity of a black hole and form galaxies.  
A spiral galaxy, similar to ours.





Our galaxy is a spiral galaxy and is 100 million light years across, forming the milky way, seen at night, as we are on the periphery of one of four arms.

Light travels at 300,000 ( $3 \times 10^5$ ) kilometres a second. Earth is 8 and a half light minutes from the sun, that is  $15.3 \times 10^6$  kilometres.

A light year is  $9.46 \times 10^{12}$  kilometres and the nearest star to ours is Alpha Centauri over 4 light years away.

There are billions of stars in a galaxy and billions of galaxies in the universe.



Clouds of cosmic gas in which stars are forming

The Hubble space telescope has improved our knowledge immensely and produced wonderful pictures.

About 4 billion years ago our solar system came into being and the earth was formed by the impacts of meteors and comets containing water.

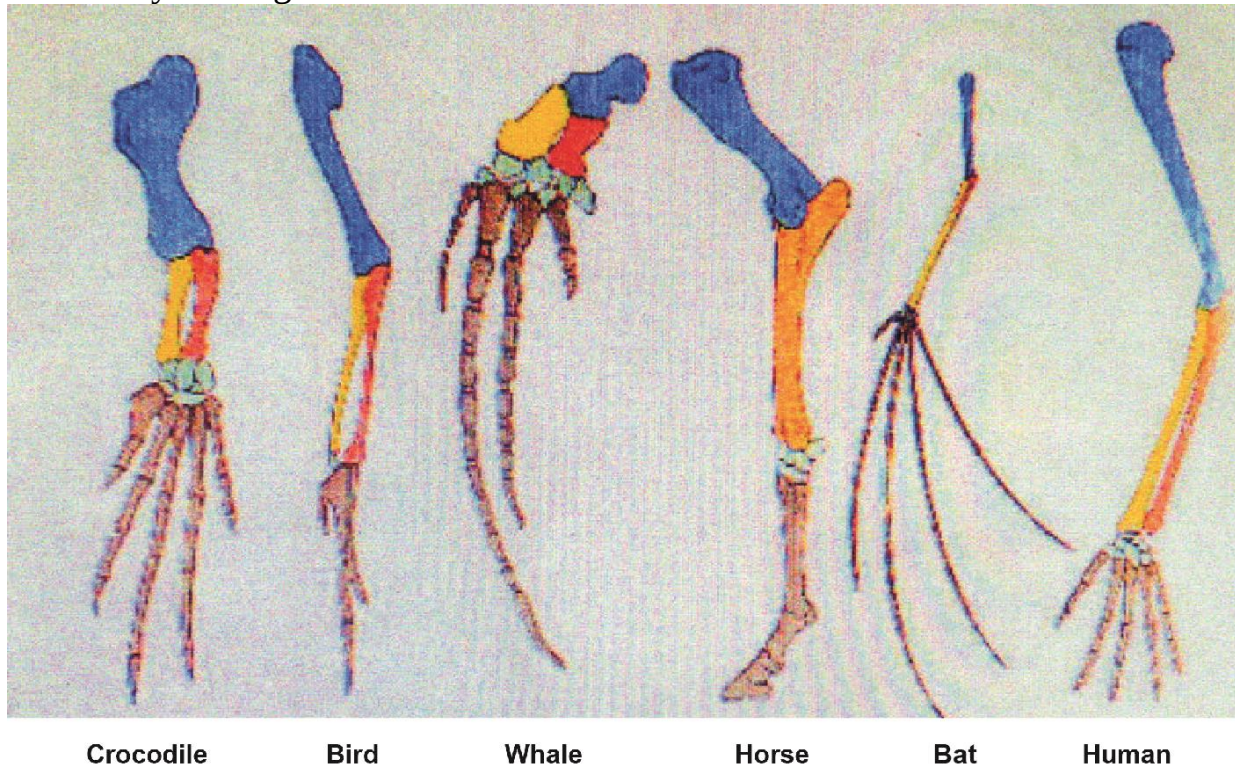


Life developed in the primordial oceans about 3 billion years ago and gradually evolution commenced.

We are in the “goldilocks” zone, being just the right distance from the sun, where it is not too hot, nor too cold for life to exist.

Complex life forms developed in the oceans, and animals that developed a back bone are called vertebrates. Fish fins turned into pentadactyl limbs, as animals crawled onto land. Warm blooded animals became mammals.

A pentadactyl limb has a single upper bone, two lower bones, several smaller bones, and 5 dactyls or digits.



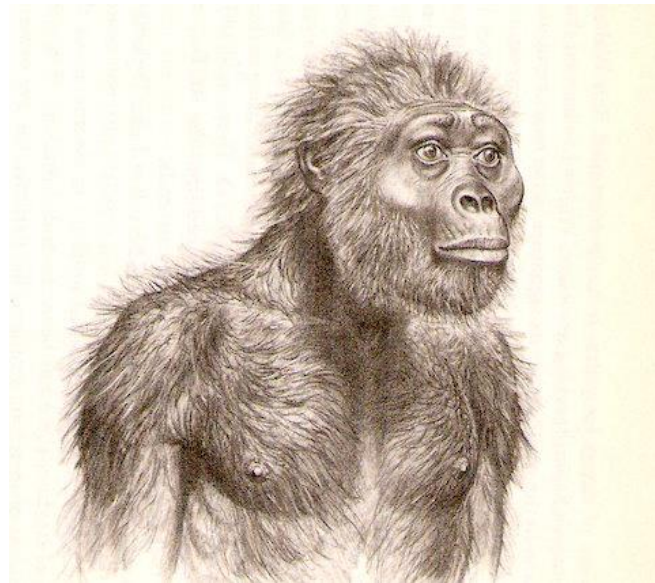
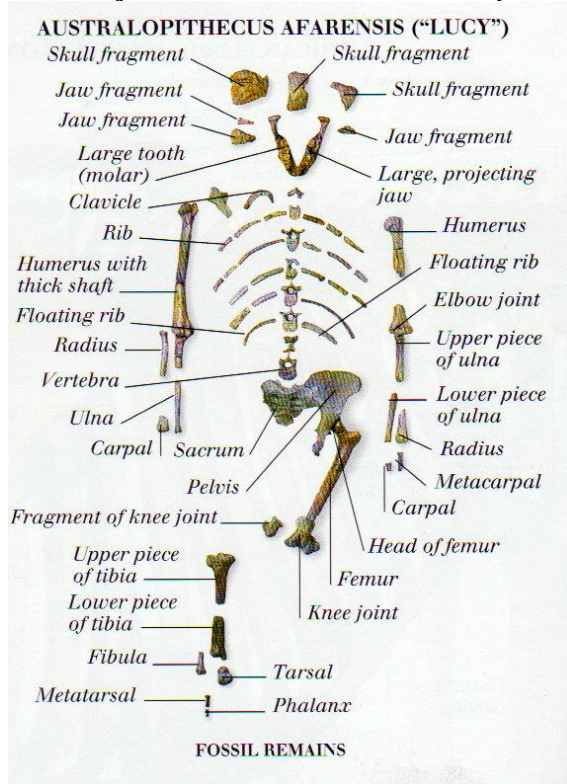
Evolution has modified this arrangement in different animals such that horses walk on only a finger or toe nail, with the other bones incorporated.

If one condenses the history of earth of 4 billion years into a single 24 hour day then complex life has only been around for about 3 hours and humans for about 5 seconds.

The first “human” to stand and walk on two legs was “Lucy”, Homo Australopithecus, about 3 million years ago. She left her footprints in the mud, fell over, died, and became a fossil.

Only about half her skeleton was present but they were able to conclude that she stood about a metre tall and was a female by the shape of her pelvis.

She was dug up by **Don Johanson, 1943-**, in 1974 when the Beatles' song "Lucy in The Sky with Diamonds" was top of the hit parade and the nickname stuck.



What she did for us was liberate our hands, so we became tool makers, and now the dominant species on the planet (although cockroaches will probably outlive us).

This homunculus shows the amount of our brain devoted to our hands and face. Note the size of the legs and feet



Further variants of upright apes evolved until *Homo Sapiens* (us) about 200, 000 years ago.

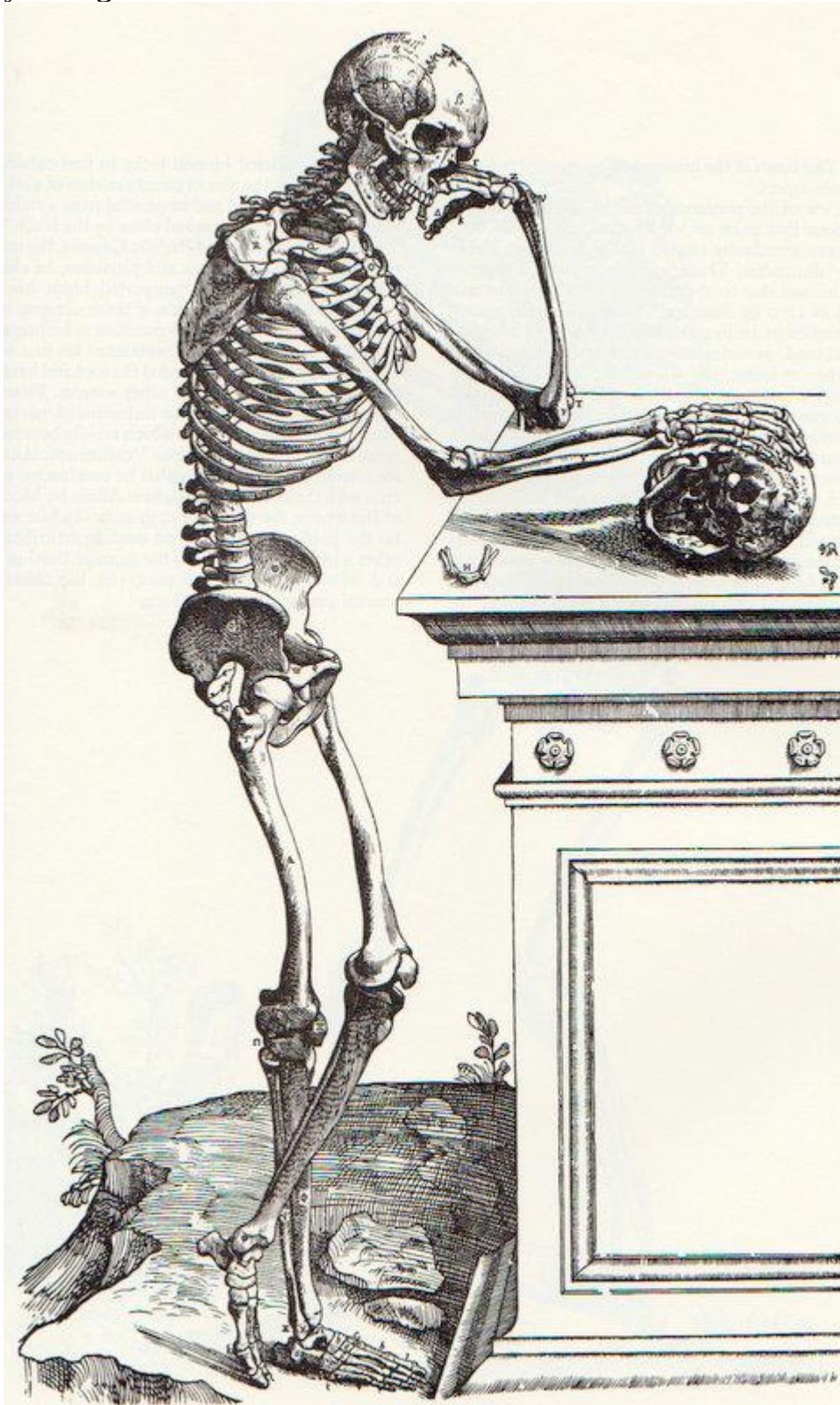


Plate from “*De Humani Corporis Fabrica*”, see page 18)



## CHAPTER 2 PRE-HISTORY TO THE GREEKS

Early humans were social animals and after emerging from Africa went on to colonise the world. They used land bridges when the sea levels were low, due to ice ages.

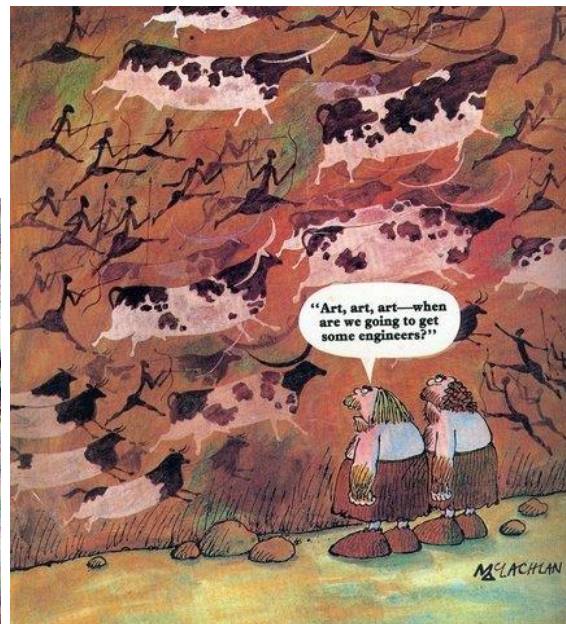
They learnt to paint images on limestone cave walls using charcoal, crushed rocks such as ochre for red, and incorporated swellings in the rock face into their art.



These paintings are from Lascaux in the Dordogne region of France



This from Rouffignac, also in the Dordogne





By then, these Cro Magnon men, as they became known, had learnt how to shape flints into sharp cutting implements.

We are not sure why, but presumably a member of the tribe became a shaman or medicine man, and they started cutting holes in fellow tribesmen. Some survived as the hole edges rounded, indicating healing (lower skull) and others died, with sharp edges.



Not to scale, but about 10 cm long



About 20,000 years BCE (before common era)



Time passed and civilisations rose and fell.

Men learnt how to smelt copper and mixed with tin, made bronze.

Then iron ore was melted and formed weapons and other tools.



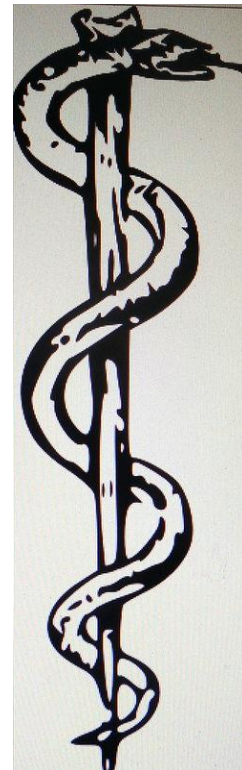
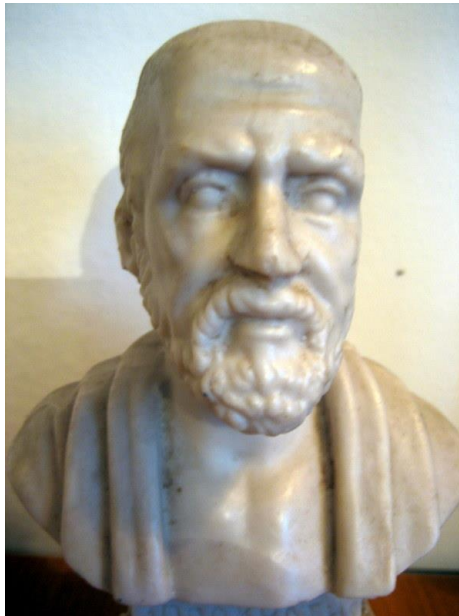
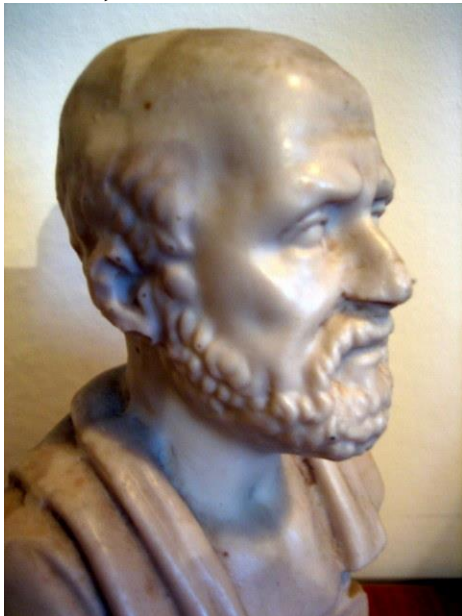


I am not sure the recipient of this surgery would have been a happy customer. The Greek civilisation and then the Roman intermingled with the Egyptian.

**Asclepius**, thought to be a god of healing, is remembered for the famous staff and may have lived around 600 BCE.

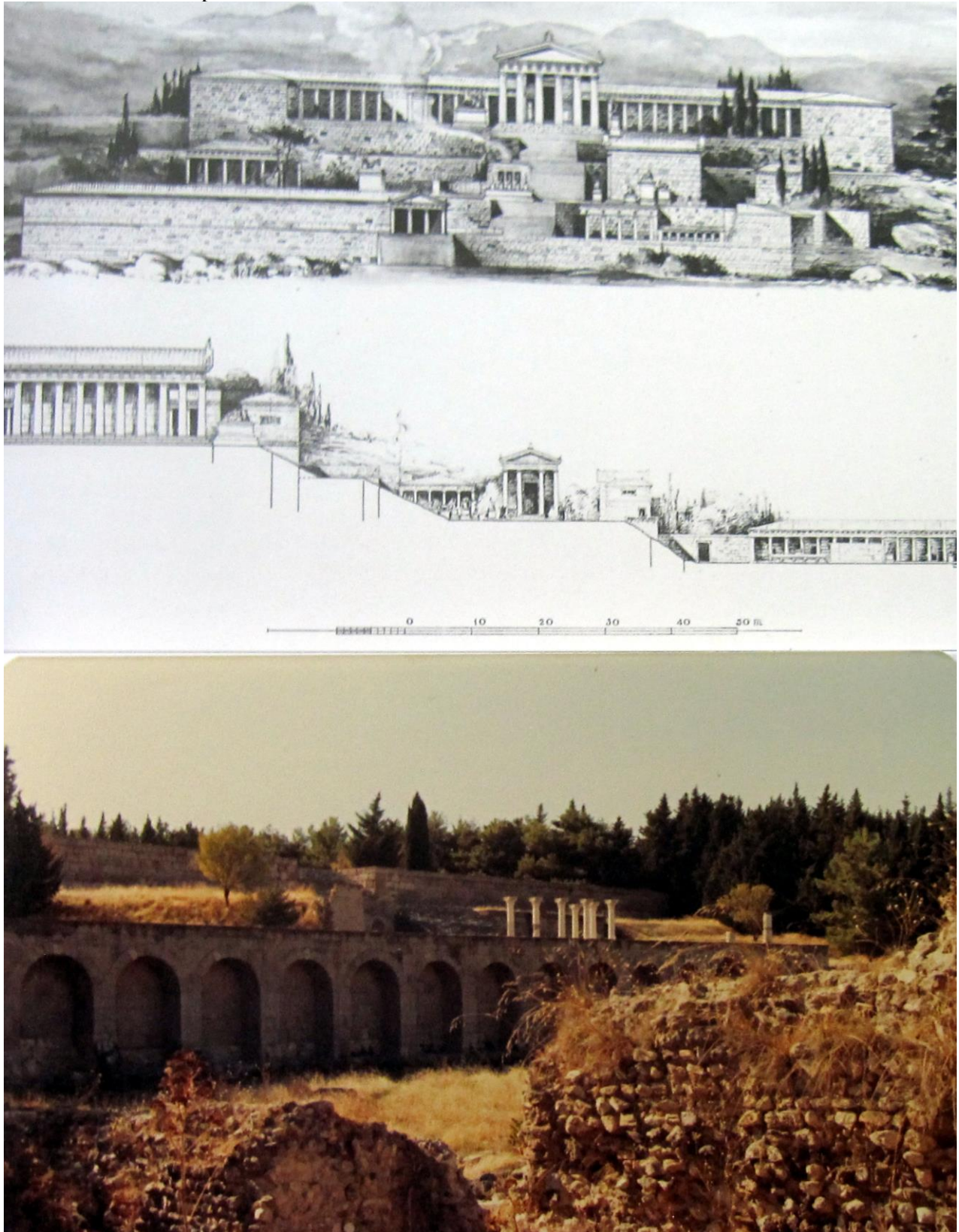
**Hippocrates**, said to be the father of modern medicine, founded a hospital on Cos around 400 BCE.

It is not known what he looked like but statues purported to be of him, look like this





He founded a hospital on Cos not far from Rhodes and remnants still exist.



His oath to students was essentially to do your best, but to do no harm



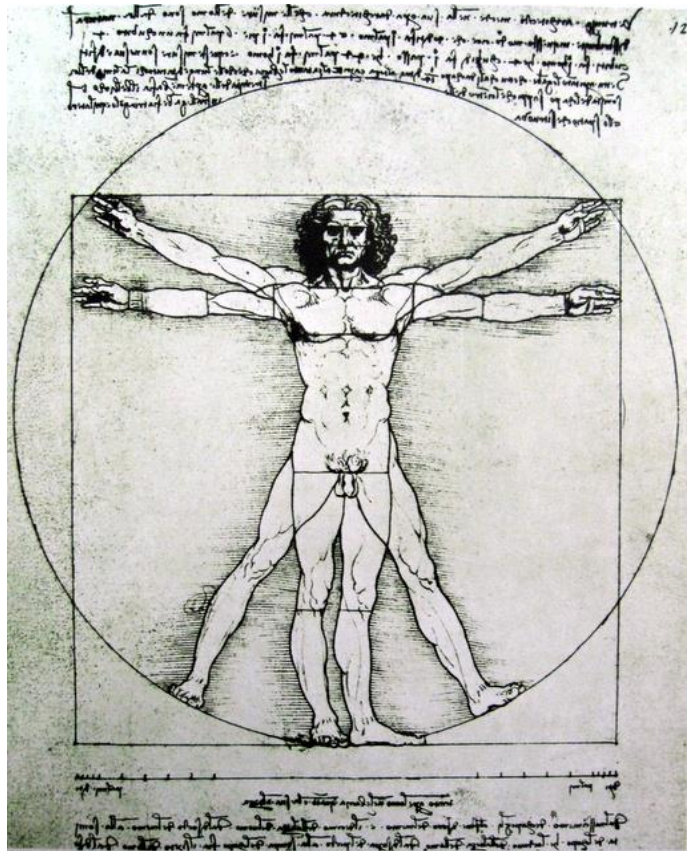
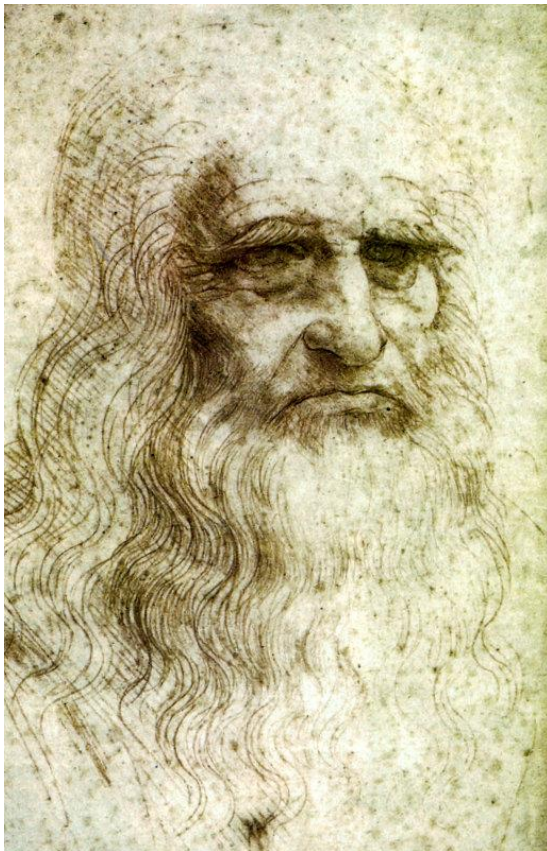
## CHAPTER 3 THE RENAISSANCE

Nothing much changed for the next 1600 years. Surgeons became adept at treating wounds but there was little increase in theoretical knowledge

The **Renaissance** came in the 15<sup>th</sup> century and people started to question how the body worked, and whether what they had been taught was true. The same applies today.

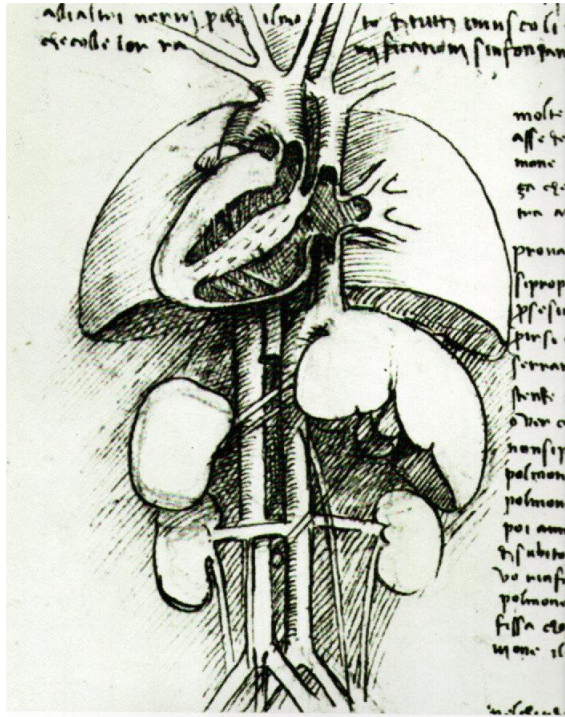
Interest in **ANATOMY** surged.

**Leonardo da Vinci, 1452-1519**, (contrary to the church's teaching of the time) dissected bodies to try to find out how the body worked. He is famous for Vitruvian man, his mirror writing (he was left-handed) and most of all the Mona Lisa.



He also developed and made a double helix staircase in Chateau Chambord in the Loire when he was a guest of King Francois 1 of France, where an army could march up one side and down the other and not see each other. Perhaps he anticipated the double helix of DNA?





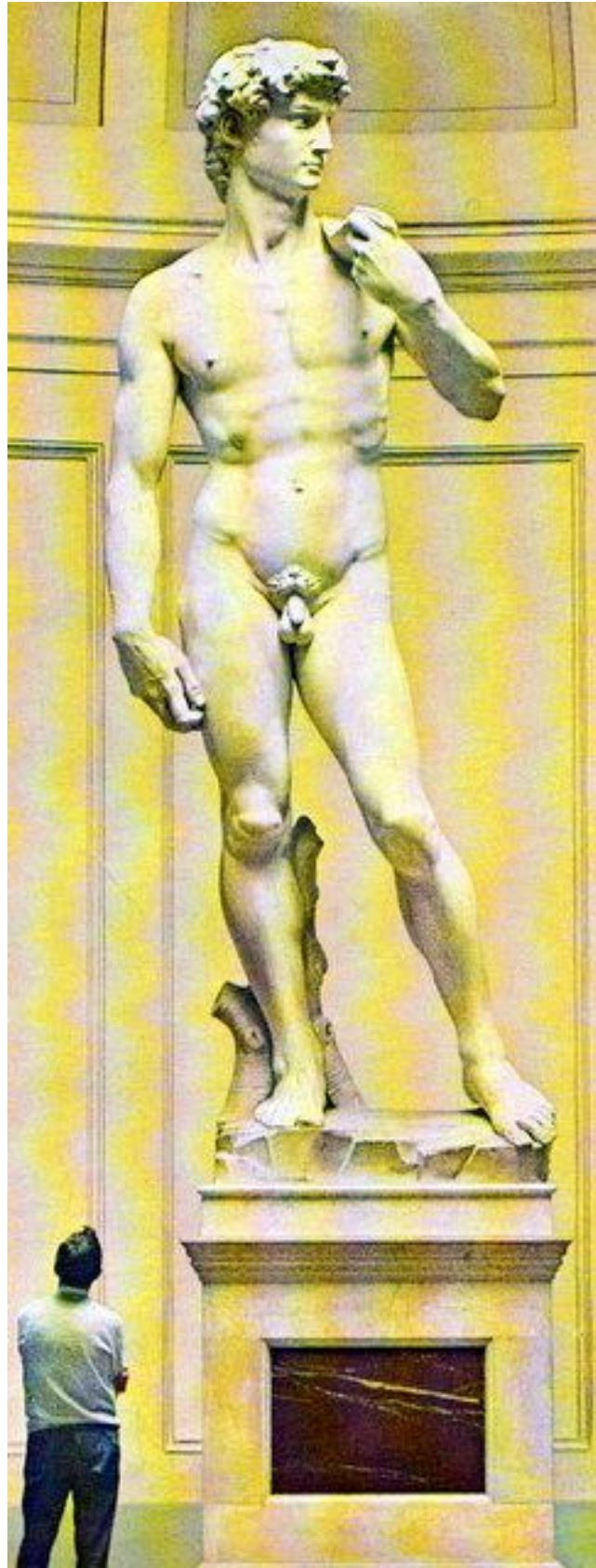
Note this image is seen from behind

The finest collection of these anatomical drawings is at Windsor castle, UK in the possession of the Queen.

**Michelangelo Buonarroti, 1475-1564**, was another great artist and sculptor of the period and also produced beautiful anatomical drawings. He is remembered for St. Peters Basilica in Rome and the Sistine chapel ceiling.







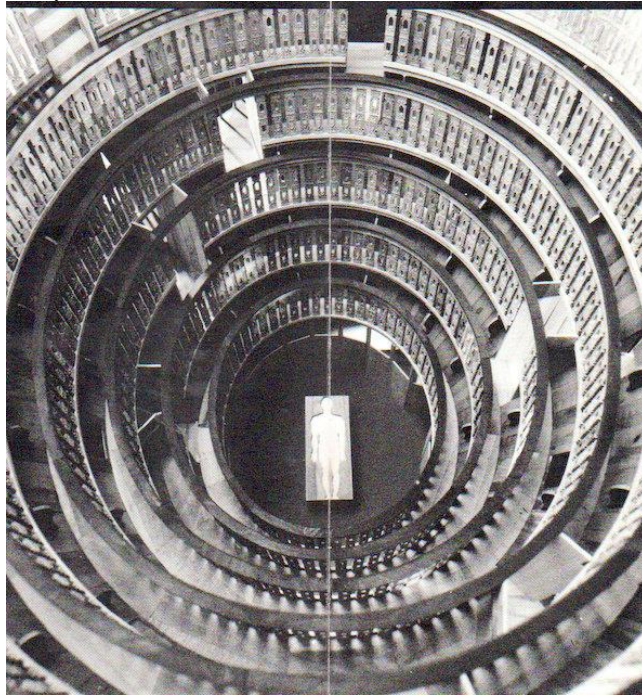
His giants struggling to emerge from the stone are very evocative, as is his stature of David, both found in Florence in Italy.



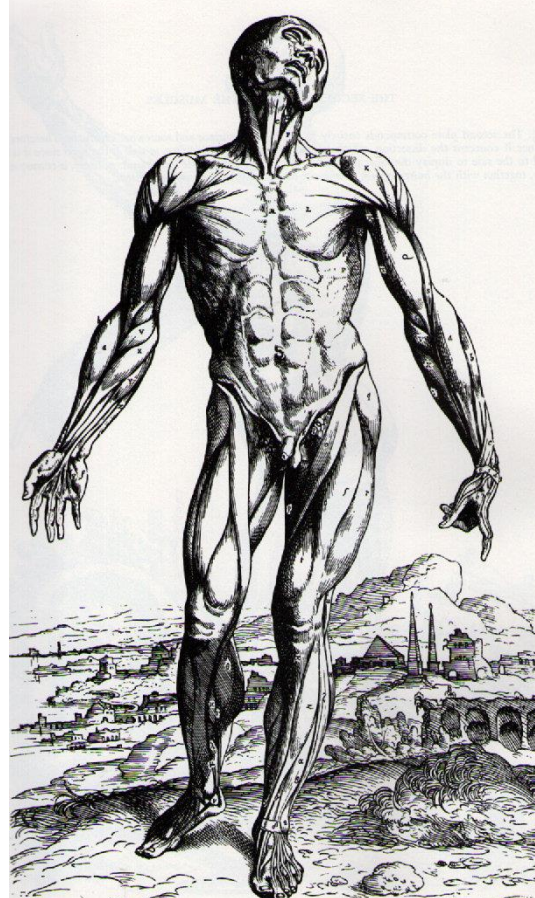
**Andreas Versalius, 1514-1564**, was responsible for a major contribution to anatomy with his book “De Humani Corporis Fabrica” published in 1543, Title page and plate below (see also page 10).



Woodcut portrait



University of Padua Anatomical lecture theatre





**Ambroise Paré, 1510-1590**, joined the French army as a doctor when various wars were being fought in Europe at the time. He kept a journal over his long life and his writings are still pertinent.



When he was a freshwater surgeon, as he described himself, he wrote: *I had not yet seen gunshot wounds at the first dressing. I had read in Jean de Vigo's book "Of wounds in General" Chapter 8 that wounds made by Gunpowder partake of venomosity, and for their cure he bids you cauterise with oil of elder, scalding hot, mixed with a little treacle.*

*And to make no mistake, before I would use this said oil, knowing it would bring great pain to the patient, I asked first, before I applied it, what the other surgeons used for the first dressing: which was to use the said oil, boiling well, into the wounds and tents and setons (drains); wherewith I took courage to do as they did.*

*At last my oil ran short; and I was compelled to apply a digestif (salve) made of yolk of eggs, oil of roses and turpentine. In the night I could not sleep in quiet, fearing some default in not cauterising, lest I should find those to whom I had not applied the said oil, dead from the poison of their wounds; which made me rise very early to visit them; where beyond my expectation, I found that they to whom I had applied my digestif had suffered but little pain, and their wounds without inflammation or swelling, having rested fairly well that night.*

*The others to whom the boiling oil was applied, I found feverish with great pain and swelling around the edges of their wounds. Then I resolved never more to cruelly burn these poor men with gunshot wounds.*





Another entry from the same campaign:

*We entered pell mell into the city and in a stable where we thought to lodge our horses we found four dead soldiers and three propped against the wall. They neither saw, heard, nor spoke and their clothes were still smouldering, burned with gunpowder.*

*As I was looking on them with pity, there came an old soldier who asked me if there was any way to cure them? I said, No.*

*Then he went up to them, and cut their throats gently and without ill will.*

*I told him he was a villain! He answered: he prayed God that when he was in such a plight, he might find someone to do the same for him, that he should not linger in misery.*

Towards the end of his career, he was sent by the king to look after Monsieur le Maquis d'Aurel, a young man who was dying as a result of an open fracture of his thigh.

He wrote: *I found him in high fever, his eyes deep sunken, with a moribund and yellowish face, his tongue dry and parched, and the whole body wasted and lean, his voice low, as of a man very near death.*

*I found his thigh much inflamed, suppurating and ulcerated, discharging a greenish and very offensive sanies. I probed it with a silver probe, wherewith I found a large cavity in the middle of the thigh and others around the knee; also several scales of bone, some loose, others not.*

*There was a large bed sore; he could rest neither day nor night and had no appetite to eat but very thirsty.*

*Seeing and considering all these great complications and the vital powers thus broken down, truly, I was very sorry I had come to see him because it seemed to me there was very little hope he could escape death. All the same, to give him courage and good hope, I told him I would soon set him on his legs by the grace of god and the help of his Physicians and Surgeons.*

*Having seen him I went for a walk in the garden and prayed god to show me this grace, that he should recover, and to bless our hands and our mendicants to cure such a complication of disease. I turned in my mind what measures I must take to this end.*

*They called me to dinner. I came into the kitchen, and there I saw, taken out of a great pot, half a sheep, a quarter of veal, three great pieces of beef, two fowls, and a very large piece of bacon with abundance of good herbs. Then I said to myself that the broth of the pot would be full of juices and very nourishing.*

*After dinner, we began our conversation, all physicians and surgeons together; in the presence of Monsieur le Duc d'Ascot and some other gentlemen who were with him. I began to say to the surgeons that I was astonished they had not made incisions in the patient's thigh, seeing as it was suppurating and the thick matter very foetid and offensive, showing it had long been pent up there; and I had found with the probe caries of the bone and scales of bone already loose.*

*They answered me: Never would he consent to it, and indeed it was near two months, since they had been able to get clean sheets on the bed, and that one scarce dared to touch the coverlet so great was his pain.*

*Then I said, to cure him, we must touch something else than the coverlet of his bed. Each said what he thought of the malady of the patient and in conclusion they all held it hopeless.*

*I told them there was still some hope, because he was young, and God and Nature sometimes do what seems to physicians and surgeons impossible.*

*I proposed three incisions for drainage, fomentations, a clean bed, hot water bottles, a pillow so adjusted as to relieve pressure on the bedsore, dusting powders, an opiate to ensure good sleep at night, and a moderate allowance of wine. To help sleep artificial rain must be mad by pouring water from a height into a cauldron so that it made the soothing sound of falling rain.*

*The diet should include raw eggs, plums stewed in wine and sugar, good broth from the pot, fowls and other roast meats easy to digest, good bread that was neither too stale or too new. Medicines must be properly flavoured to disguise their taste*

*This, my discourse was well approved by the physicians and surgeons. The consultation ended, and we went back to the patient, and I made three incisions in his thigh. Two or three hours later, I got a bed made near his old one with clean white sheets on it; then a strong man put him into it and he was thankful to be taken out of his foul stinking bed. Soon afterwards he asked to sleep; which he did for nearly four hours; and everybody in the house began to feel happy, and especially his brother.....*

*Then, when I saw him beginning to get well I told him he was to have viols and violins and a buffoon to make him laugh; which he did. In a month, we got him into a chair; and he had himself carried about his garden, and to the door of his chateau to watch people passing.*



*The villagers for two or three leagues round, now they could see him, came on holidays to sing and dance, a regular crowd of light hearted country folk, rejoicing in his convalesce, all glad to see him, not without plenty of laughter and plenty of drink. He always gave them a hogshead of beer and they all drank his health with a will.*

*In six weeks he began to stand a little on crutches, and to put on flesh and to get a good natural colour. He wanted to go to Beaumont, his brother's place and was taken thither in a carrying chair; by eight men at a time. And the peasants, in the villages through which we passed, when they knew it was monsieur le Maquis fought who should carry him, and insisted he should drink with them; and it was only beer, but they would have given him Hippocras (a fortified wine) if there had been any; and all were glad to see him, and prayed God for him.*

Paré said: *Je l'ai traité, Dieu l'a guéri* (I treated him, God cured him)

Paré understood that he assisted nature, not the other way round, and many young doctors today should remember that.

## King Henry VIII, 1491-1547



In the fifteenth century barbers used to perform minor surgical procedures such as lancing boils as well as cutting hair. They formed a Guild in London in 1493 which was formalised by Henry VIII in 1540 to form the Company of Barber-Surgeons.

In 1745 the surgeons broke away from the barbers to form the Company of Surgeons and was granted a royal charter to become the Royal College of Surgeons in London in 1800 and the Royal College of Surgeons of England in 1843.

Physicians of the day were called doctors and surgeons were called Master or Mister which has come down to the present day in the UK and certain parts of Australasia.

The Royal Australasian College of Surgeons evolved between 1925-1927 and the first Council meeting was held in Dunedin, New Zealand in 1927. Training meant some years in the UK, or the USA after World War II, but today surgeons are trained locally.

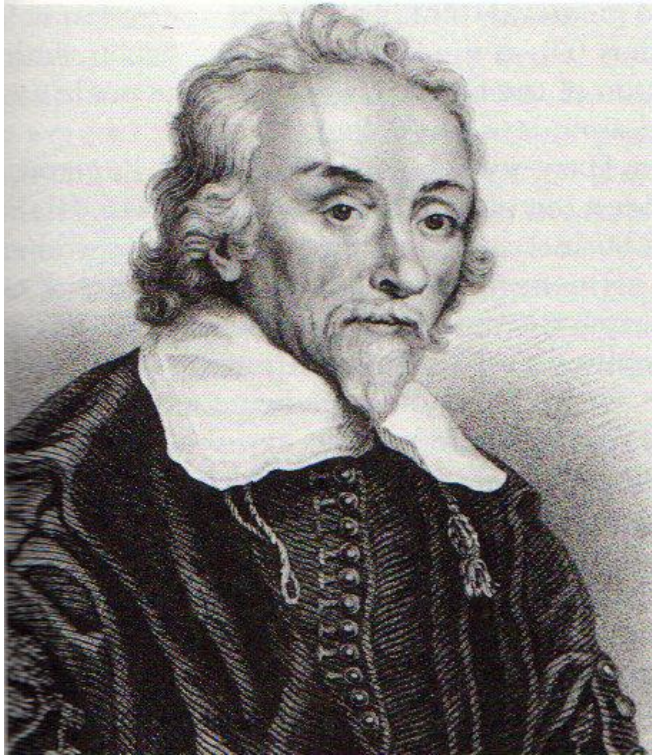
Because the barber surgeons dealt with blood, the barber's pole of red, white and blue was supposed to represent arterial blood, venous blood and white bandages. It is still in use today, but not by surgeons.





## Chapter 4 THE SEVENTEENTH CENTURY

### William Harvey, 1578-1657

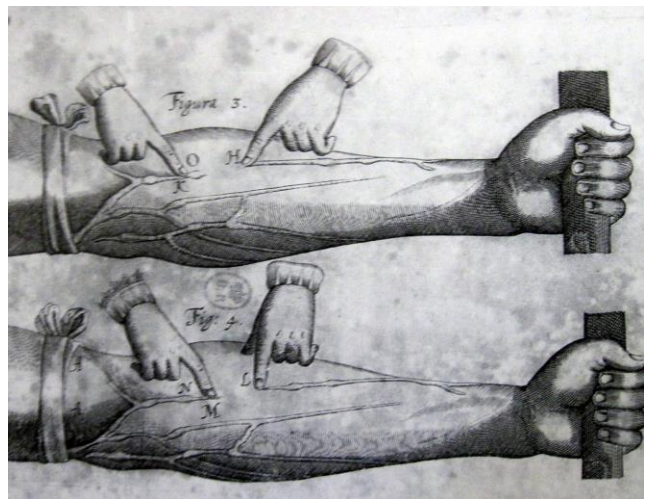


He graduated in medicine from Cambridge university and became a physician, which required a degree as the barber-surgeons did not.

He studied in Padua and wrote an early treatise on the circulation of the blood in animals before finally publishing “De Motu Cordis” in 1628 proving that the heart was a pump and blood circulated, even though the discovery of capillaries connecting arteries and veins had not yet been found, but

**Marcello Malpighi, 1628-1694,** discovered them later, confirming the link.

His theory was scoffed for some years by his colleagues, as Galen had written some 1500 years earlier that blood went back and forth like the tides, and they could not countenance a revolutionary theory.





Even though Charles 1<sup>st</sup> was a patron, his ideas took many years to be accepted.

This painting shows Harvey demonstrating his experiments on deer to King Charles.

Interestingly, **Miguel Severtus, 1509-1553**, a polymath in Spain, who correctly described the pulmonary circulation, was burnt at the stake, condemned by Protestants and Catholics alike, as a heretic for his views on the divinity of Christ.

### **Antony van Leeuwenhoek, 1632-1723**

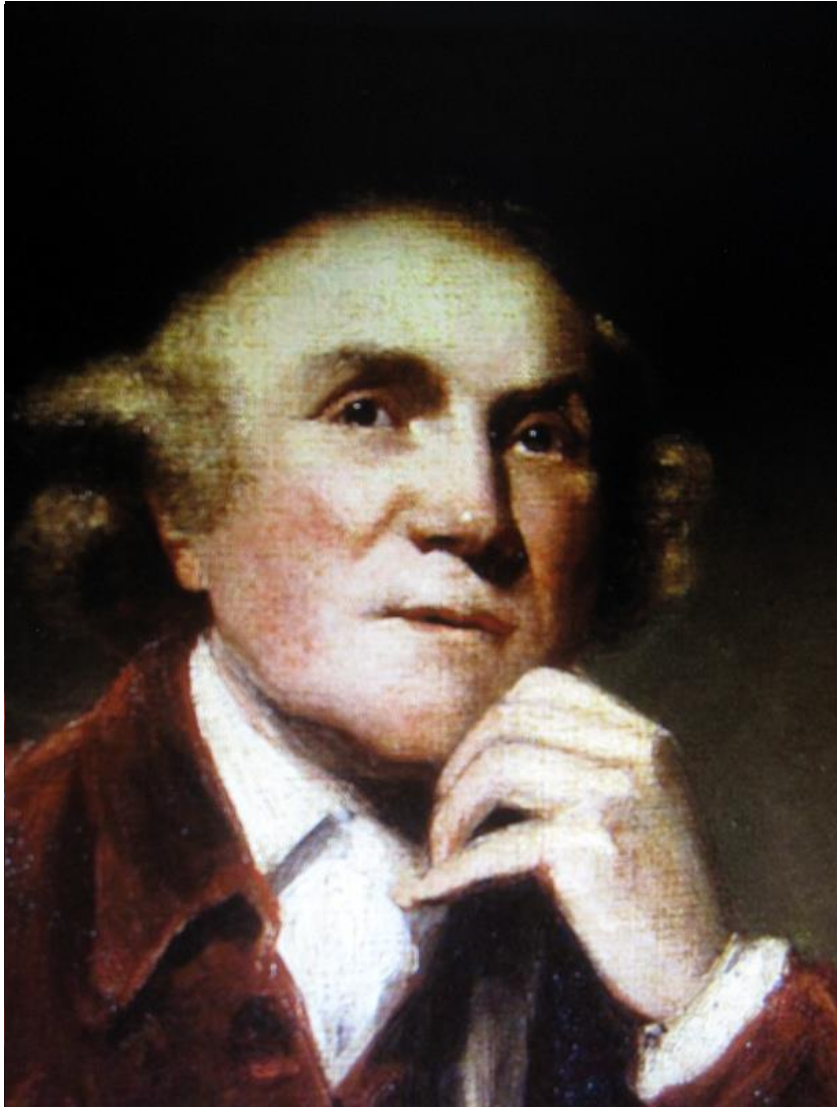


He lived all his life in the Netherlands but corresponded with the Royal Society in London. He took up microscopy as a hobby, grinding his own lenses. He discovered spermatozoa and red blood cells.

In 1674 he found what he called *animalcules* in a drop of water in which he had put a scraping from his teeth. He then discovered them in different places such as in pond water, other person's mouths, and faeces. No-one at that time connected these microbes with disease, and medicine had to wait until Pasteur, in the nineteenth century, was able to prove the association.



## CHAPTER 5 THE EIGHTEENTH CENTURY



The dominant figures of the Eighteenth century were the **Hunter brothers. William, 1718-1783, and John 1728-1793** (pictured).

Both were born in Scotland, but William, being 10 years older went to University to study law, but came under the influence of Dr Cullen who introduced him to medicine and in particular Obstetrics.

He subsequently settled in London and became a fashionable man midwife, with an anatomy school. He became the father of modern Obstetrics.

John later joined him, and became the father of modern surgery.

He found ligating an artery could “cure” an aneurysm. He extracted and implanted teeth as a livelihood when he first went into practice.

He found that leaving musket balls in wounds caused less harm than seeking them. He laid the foundation for evidence-based treatment.

He collected numerous specimens of animal and human peculiarities, and these are preserved in The College of Surgeons in Lincolns Inn Fields in London.

He already had a skeleton of a dwarf, Teresa Crachiami, who stood 22 inches (55cm) tall, but was missing a giant. In 1782 an Irishman, Charles Byrne, standing 8feet 2inches (245cm) came to London and put himself on show, charging two shillings and sixpence to come and see him.

John Hunter sent his factotum Howison, to negotiate the purchase of his body when he died, as he was already sick with tuberculosis and alcoholism.

This was rejected outright, and the giant ordered a lead lined coffin to be built and his body to be taken to the middle of the English Channel and buried at sea.

He hired Irish corpse watchers to undertake the task, but these John Hunter bribed, and for an extraordinary sum of 500 guineas (about \$250,000 today), so that at the moment of death the empty coffin went down the front stairs, and the body down the back stairs, to be taken by coach to John Hunter's house and museum in Earls Court where it was boiled down and the skeleton mounted.

It was only after 2 years that John Hunter admitted to the possession of a giant skeleton.



Both can be seen in the **College of Surgeons Museum** today in Lincoln's Inn Fields as they were spared when the College was bombed during the blitz in 1941.

**Edward Jenner, 1749-1823**, was one of John Hunter's pupils and went on to become famous in his own right after discovering that milkmaids who had had cowpox did not contract smallpox, a lethal infection at the time and since. Hunter had written to him "Why think, why not try an experiment" and this is basically the foundation of all science.



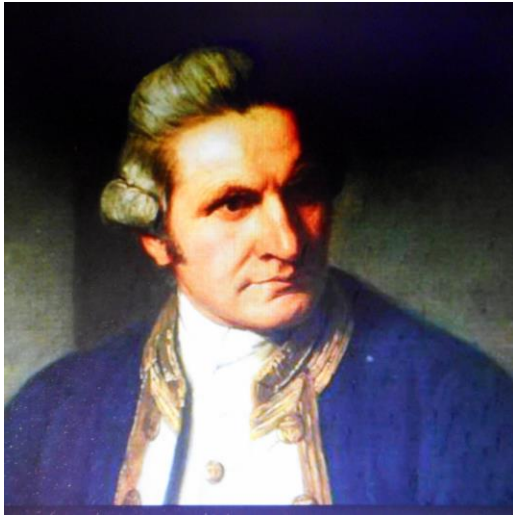
He injected his own son to prove he was right.

This sculpture shows him inoculating James Phipps in 1796.

He was also ridiculed by his colleagues at the time before it became obvious that inoculation succeeded



**Captain James Cook, 1728-1779**, circumnavigated the globe three times, 1768-1780, with each voyage lasting over three years. He mapped the coastlines of New Zealand and Australia.



He was slain by Hawaiian islanders on his way back to Britain on his last voyage.

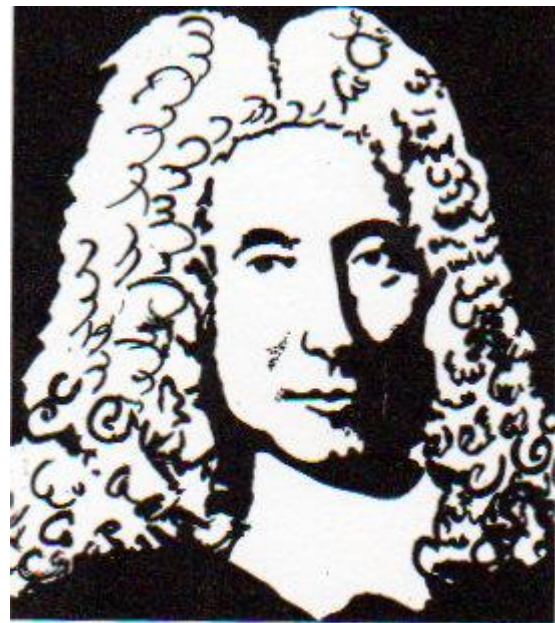
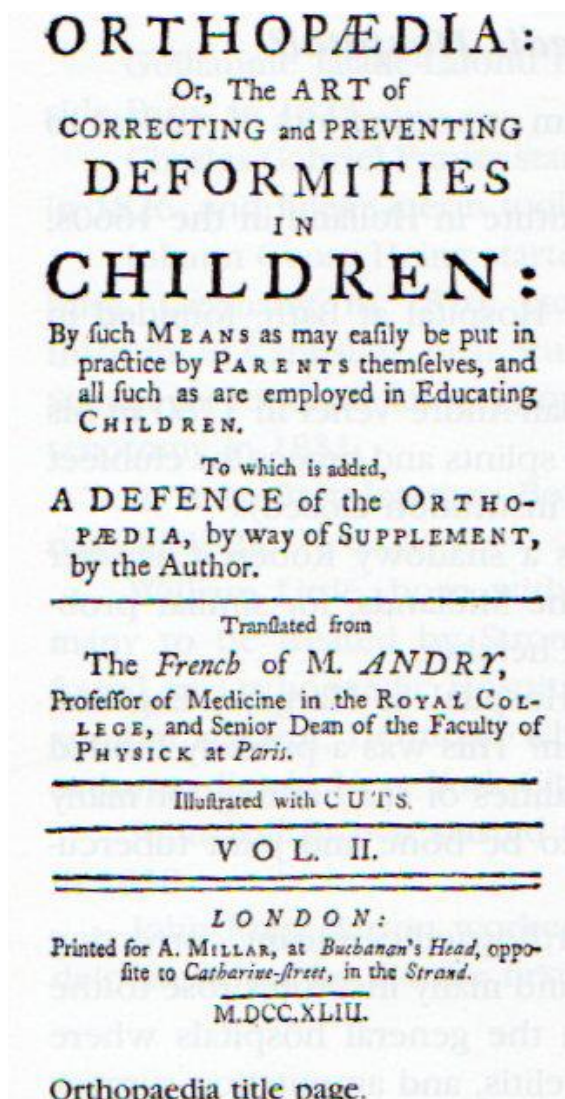
He made his crew members eat raw onions and sauerkraut; thus he was able to prevent scurvy.

A deficiency in this vitamin (vitamin C), over time resulted in weakness in the formation of collagen and led to bleeding, teeth falling out and death.

It was not understood at the time, but it was a major factor causing death on long sea voyages.

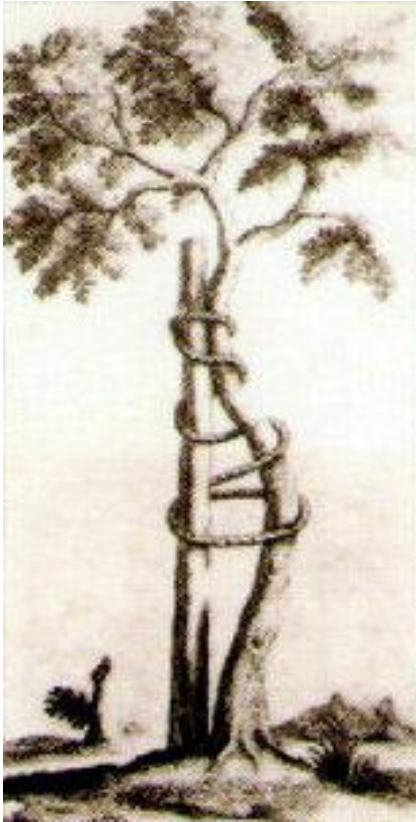
The British Navy introduced oranges and limes as another preventive measure and the sailors became known as “limeys”.

**Nicholas Andry, 1658-1742**



◆ Nicholas Andry

He made up the word Orthopaedia from two Greek words; Orthos meaning straight or upright, and Pais, child, or Paedia, the study of children, for a book he wrote in 1741 at the age of 81 on the means of preventing deformities in children.

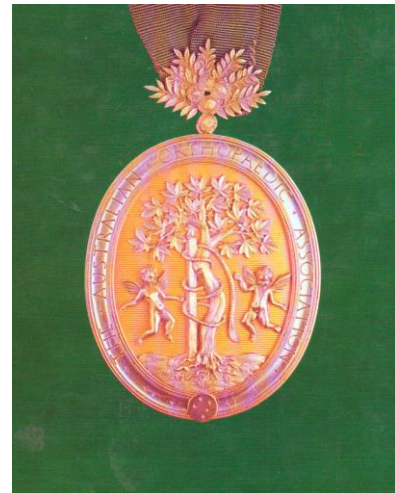


He used this tree on the cover of his book.

This tree has become the symbol of every orthopaedic society around the world, even though modern orthopaedics deals with adults as well as children and involves all aspects of the musculo-skeletal system.

This is the badge of the Australian Orthopaedic Association

Orthopaedics today has subspecialised, with surgeons dealing with the shoulder, or hip, or knee, for example



**René Laennec, 1781-1826.** A Frenchman, credited as the inventor of the stethoscope. He was deeply religious and wanted to protect a woman's modesty, as doctors had simply placed their ear to the chest to listen to the heart-beat.



He was examining a rather obese woman with a heart problem, and used a rolled up tube of paper to listen the heart in 1816, and then developed a simple wooden stethoscope. This later evolved into the modern bi-aural, familiar object used today.





## CHAPTER 6 NINETEENTH CENTURY

### ANAESTHESIA

**Sir Humphrey Davy, 1778-1829**, along with many of his English and Scottish



contemporaries at the time was interested in the natural world and performed many experiments, discovering various elements including sodium and potassium. He invented the miner's safety lamp, which reduced the risk of explosions underground, common at the time.

He discovered nitrous oxide, or laughing gas, and this was used at parties at the time, but he failed to recognise the anaesthetic qualities.

His protégé was **Michael Faraday, 1791-1867**, who actually discovered ether, but also failed to note it was an anaesthetic gas. Faraday went on to find a way to make electricity by revolving a magnet within a coil of wire and demonstrated this at the Royal society meeting in 1826.



In America, at the time in the early 1840s, it was observed that after inhaling ether or nitrous oxide at these parties, that participants did not feel pain if they injured themselves.

**Crawford Long, 1815-1878**, a doctor removed three small tumours from a lad in 1842 under ether, but did not publish until after **Horace Wells' 1815-1848**, demonstration in 1845 of nitrous oxide at the Boston Massachusetts General hospital in Boston. He was a dentist, who had extracted teeth under nitrous oxide, but he failed in his demonstration of this gas and was discredited.

**William Morton, 1819-1868**, a partner of Wells did, however, mount a successful demonstration in October 1846, when he removed a tumour from beneath a patient's jaw, using ether.

This painting was made by Robert Hinckley in 1882, showing the demonstration.



Morton and Wells fell out over who was the true discoverer of anaesthesia, with Wells later committing suicide. Morton was unable to prove he was first, resulting in dire financial straits, until he died of a stroke in 1868.





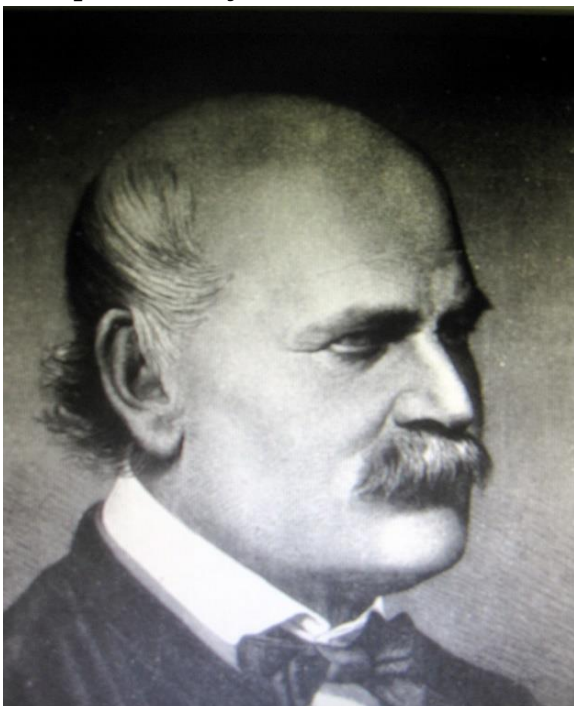
Back in the United Kingdom, experiments were being made with other agents and **Sir James Simpson, 1811-1870**, a Scotsman, discovered that Chloroform had less side effects than ether and started using it in his obstetric practice.

Queen Victoria liked Scottish doctors and he became her Obstetrician for the birth of Prince Leopold in 1853.

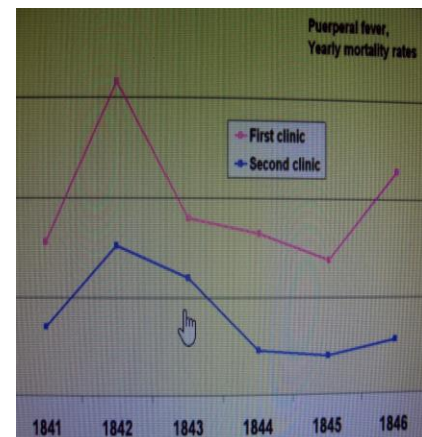
Unfortunately, chloroform was later found to cause cardiac arrhythmias and death and by the late 1800s was no longer used.

## INFECTION

**Ignaz Semmelweis, 1818-1865**, was a doctor in Budapest, Hungary who worked in Vienna. He observed that childbed fever or puerperal sepsis was less common in a hospital run by nuns than in the medical school hospital.



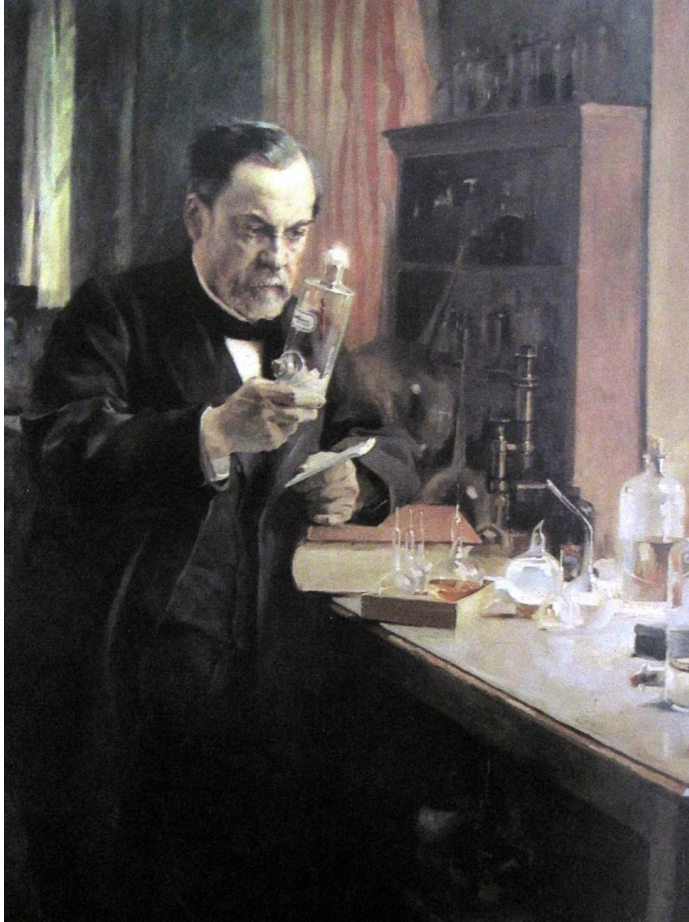
The nuns used to wash their hands before examining the women about to give birth whereas their medical colleagues did not.



Often, the doctors would go from examining a woman who had just died from the fever, to examine another about to give birth, and then wonder why she too died.

Semmelweis collected statistics to show the different mortality rates, but was shunned by his colleagues, and eventually committed to a mental asylum where he died aged 47.

**Louis Pasteur, 1822-1895**, was a French chemist who discovered the germ theory of disease.



He was initially interested in the formation of tartaric acids in wine, which led him to discover isomers (the mirror image of crystals), and then fermentation.

He found the micro-organisms which converted sugar into lactic acid (sour milk).

He studied anthrax in 1877 which was killing sheep in large numbers, and eventually produced a vaccine.

In 1880 he turned his attention to rabies and discovered a vaccine for that too.

He is remembered for “pasteurisation”, a process of delaying decomposition of food.

**Robert Koch, 1843-1910**, working in Germany also had discovered the bacteria



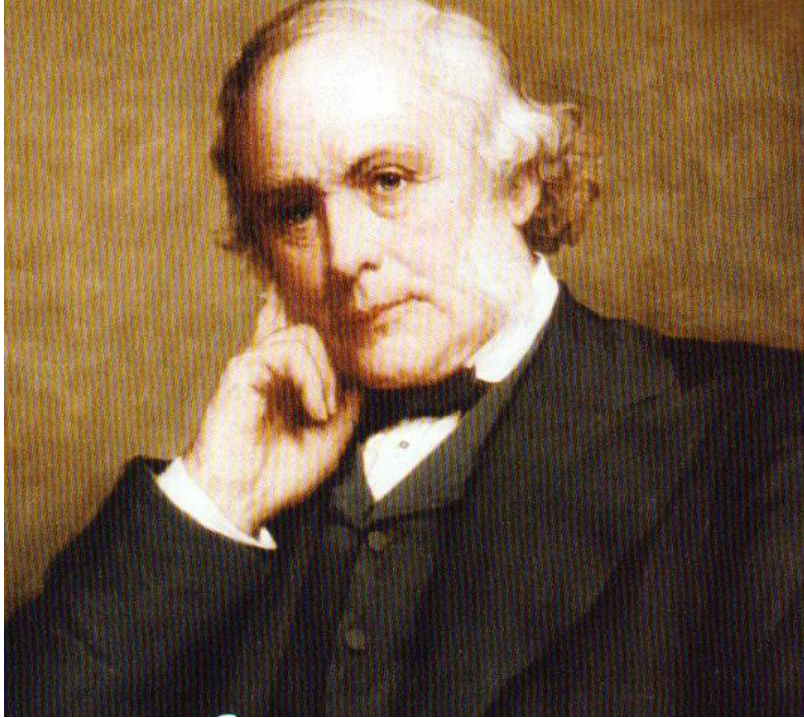
responsible for anthrax, typhoid fever, gonorrhoea, syphilis, leprosy and pneumonia.

He discovered the tubercle bacillus and received a Nobel prize in 1905 as a result.

He and Pasteur were rivals in a way, and, for example, Pasteur preferred Microbiology as a term, whereas Koch preferred Bacteriology.



**Sir Joseph Lister, 1827-1912**, initially studied arts graduating in 1847 but had already decided upon a career in medicine.



He studied at Edinburgh university under James Syme, a renowned professor of surgery, remembered for Syme's amputation of the foot, leaving the heel.

He was appointed as Professor of surgery in 1859 to the Glasgow University, where death rates from infection were up to 50%.

He employed techniques learned from **Florence Nightingale, 1820-1910**, who had transformed the care of the wounded in the Crimean war in 1854.

Lister became interested in anti-sepsis, particularly carbolic acid. He introduced a carbolic acid spray in 1870 but it was abandoned in 1887 as it was ineffective.

Lister himself said: *Next to the promulgation of new truth, the best thing, I conceive, that a man can do, is the recantation of published error.*

This still applies today, with the widespread belief in homeopathic medicine for example.

Aseptic methods gradually replaced antiseptics with the advent of gowns and gloves in surgery.

Before Lister, the presence of pus in the wound was considered normal, and even beneficial such that it was called Laudable pus.

In the late nineteenth century research was going on in Physics, with NZ born **Ernest Rutherford, 1871-1943**, postulating the structure of the atom in the Cavendish laboratory in Cambridge, **Marie, 1867-1934**, and **Pierre Curie, 1859-1906**, experimenting with Radium in Paris, **Albert Einstein, 1879-1955**, pondering the theory of relativity in Switzerland, publishing his most famous equation  $E=MC^2$  in 1905, **William Crookes, 1832-1937**, experimenting with Cathode ray tubes, later known as Crookes' tubes, the forerunner of TV in the UK, **Guglielmo Marconi, 1874-1937**, and the first radio transmission in 1896, **Thomas Edison, 1847-1931**, in America with the light bulb in 1879, and Serbian born but US citizen, **Nikola Tesla, 1856-1943**, with alternating current, in 1888.

## RADIOLOGY

**Konrad Röntgen, 1845-1923**, was experimenting with Cathode ray tubes in Germany. One of his photographic plates was fogged and he realised that an unknown ray was being emitted by the machine.



He asked his wife to place her hand on an unexposed plate and shone his machine on it for six minutes before developing the film.

The ray was blocked by the metal in her wedding ring and the calcium in the bones.

Because  $x$  is the mathematical symbol for unknown, he named them X-rays.

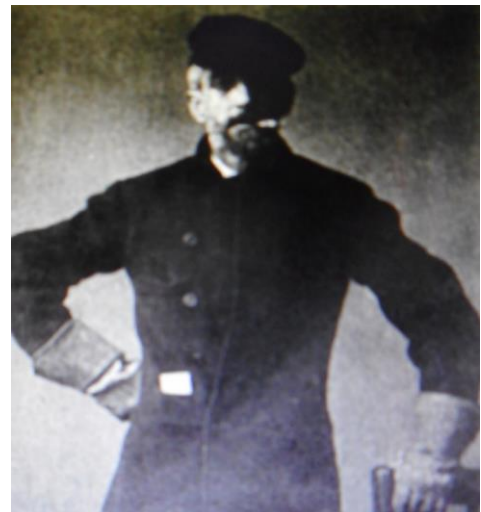
In the year after he published his results over 1000 papers were prepared by other investigators. It was found that swallowing a paste of barium sulphate or introducing it as an enema, the stomach and intestines would be displayed, showing ulcers or cancerous growths.

## BONE SETTERS

**Hugh Owen Thomas, 1834-1891.**

Before the advent of x-rays, bonesetters practiced their art, and Hugh Thomas was a leader who worked in the poorer sections of Liverpool in the UK.

He is credited with being the father of British Orthopaedics.





He invented a splint for the treatment of tubercular joint infection, particularly the knee. He advocated Rest: enforced, uninterrupted and prolonged.

Thomas splints were used in the management of lower limb injuries, and fractures in the First World War and saved many lives.

Many of the surgeons of previous eras had their names attached to various fractures and diseases such as **Percival Pott, 1714-1788**, who broke his leg in 1756 and whilst laid up (having escaped amputation), wrote a treatise on ankle fractures, known up until recently as Pott's fractures.

**Abraham Colles, 1773-1843**, described a fracture of the wrist in 1814. There are two bones in the forearm (see pentadactyl limb p3), the ulna which forms a hook at the elbow and is mainly responsible for the bending there, and the radius on the outer side which carries the hand, and is responsible for turning over and back of the forearm and movements of the wrist. A fall on the outstretched hand produces a force which results in a fracture of the distal radius resulting in a dinner fork deformity.

As Colles himself described it: *This fracture takes place about an inch and a half (almost 4cm) above the carpal extremity of the radius, and exhibits the following appearances: The posterior surface of the limb presents a considerable deformity, for a depression is seen in the forearm about an inch and a half above the end of this bone, while a considerable swelling occupies the wrist and metacarpus. Indeed the wrist and metacarpus appear to be thrown backwards so much as on first view to excite a suspicion that the carpus has been dislocated forwards.....*

### **Sir Robert Jones, 1858-1933**

He, together with **Agnes Hunt, 1866-1948**, established an Orthopaedic hospital in the countryside at Oswestry, building on the Baschurch Open Air hospital established by Agnes Hunt in 1900.



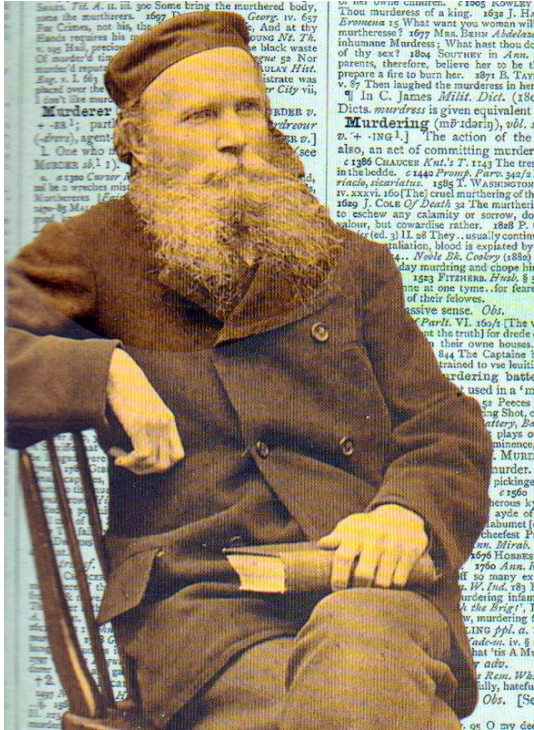
This hospital was where many Australasian surgeons in training went to further their education in the 20<sup>th</sup> century.

Further hospitals were established in the British countryside for the treatment of poliomyelitis and tuberculosis.

During the First World War he rose to the rank of Director General of Military Orthopaedics.

After the war, in 1918 he helped to form the British Orthopaedic Association.

**Dr William Chester Minor, 1824-1920**, was a surgeon who served in the Union army during the American Civil war (1861-1865), and saw many atrocities during this violent conflict which Abraham Lincoln resolved would unite the American colonies.



He emigrated to England after the war, but was suffering from paranoia, and shot dead a man in 1872. He was found to be criminally insane at trial, and sentenced to lifelong imprisonment in Broadmoor mental institution at Crowthorne, Berkshire, England.

He was interested in words and their meaning and became the largest contributor to the Oxford English dictionary being compiled by Dr James Murray. Over the next 20 years, between then, they made the dictionary, without Murray discovering his true identity, until 1897, Queen Victoria's Jubilee year,

when Murray finally met him in Broadmoor, then called a lunatic asylum.

Although not a major contributor to medical science, without words, how would we communicate?

His tale has been admirably told in Simon Winchester's book: "The Surgeon of Crowthorne", from which this picture was taken.



## CHAPTER 7 TWENTIETH CENTURY

The rate of change accelerated as more and more knowledge in all fields was found and put to use. Some ideas met with resistance, as old habits die hard.

Universities took over the initial training of doctors, nurses, physiotherapists and other health professionals.

Postgraduate training came under the provenance of the Royal Colleges and speciality Organisations such as the Orthopaedic associations of different countries.

Medicine split into experts or consultants in different fields such as cardiology, neurology and so on, as has surgery. At the beginning of the twentieth century a general surgeon could, in one list, carry out an appendicectomy, reduce a dislocation, remove tonsils and open a skull for a brain tumour.

At the end of the century all this had changed, and this started in the First World War.

Governments also improved the availability of health care through public health measures such as a clean water supply and adequate sewage disposal, national insurance schemes, vaccination of children, drug safety laws, and improved hospitals. Fluoridation of water supply reduced dental decay, not without, even now, strong opposition in spite of scientific proof of the benefit. Graphic photos of the effects of smoking on packets have been tried to reduce consumption of cigarettes, together with banning it in public places.

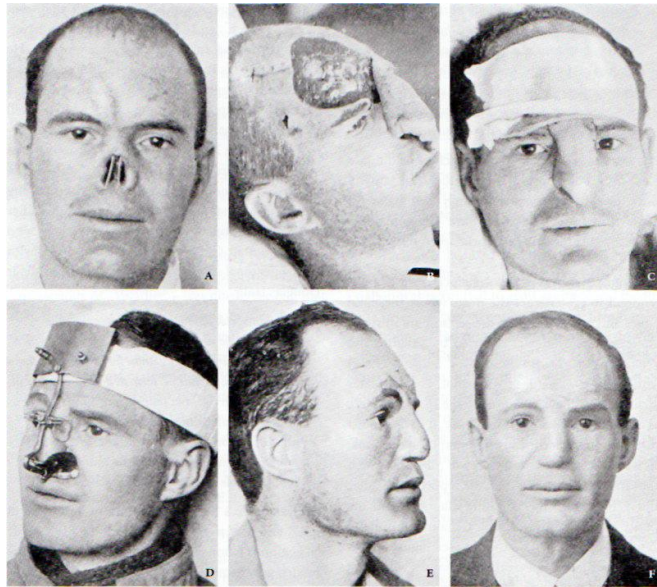
Curiosity into how the body worked, the application of scientific advances in chemistry, physics as well as technological advance in engineering, animal experimentation, the discovery of new drugs, improvements in anaesthetics and dissemination of knowledge has led to a faster and faster rate of change.

The two great wars accelerated this, at huge cost of life.

The First World War (WWI) was a classic example of outdated military practice pitting cavalry against machine guns. The horrific injuries inflicted meant rapid advances in medicine, nursing and in particular surgery.

### PLASTIC SURGERY

Four New Zealand surgeons, **Sir Harold Gillies, 1882-1960**, **Henry Pickerill, 1871-1956**, both WWI, **Arthur Mowlem, 1902-1981**, and **Sir Archibald McIndoe, 1900-1960**, both WWII, became Plastic surgeons, reconstructing hands and faces working at front line hospitals initially and later the Cambridge Military hospital, Aldershot, and then The Queen's Hospital at Sidcup.

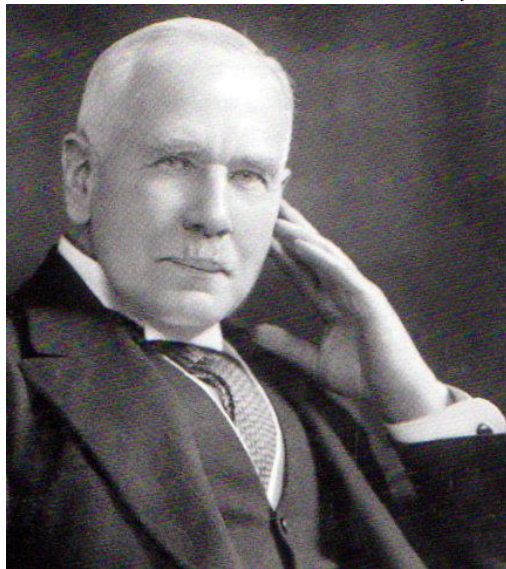


A reconstruction of the nose using a pedicle flap from the forehead, with that defect covered by a full thickness graft, and the end result after two years (photo courtesy of “Reconstructing Faces” Murray C Meikle, University of Otago Press).

This specialty was to make a major contribution in the Second World War (WWII). The badly burnt faces and hands of pilots who survived being shot down, were treated at Queen Victoria Hospital at East Grinstead. They became members of the Guinea Pig Club.

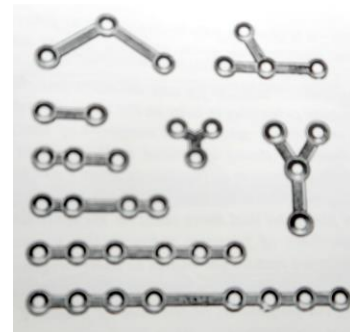
## MANAGEMENT OF FRACTURES

### Sir William Arbuthnot Lane, 1856-1938



He developed internal fixation of fractures using plates and screws in 1905. He had already introduced the “no touch” technique to avoid infection, in 1892.

At that time surgeons were unaware of electrolysis and many plates rusted and broke. Stainless steel solved this problem.



During WWI, the Thomas splint was used not only to transport patients from the battlefield, but also as a means of traction in hospitals while the bones healed.

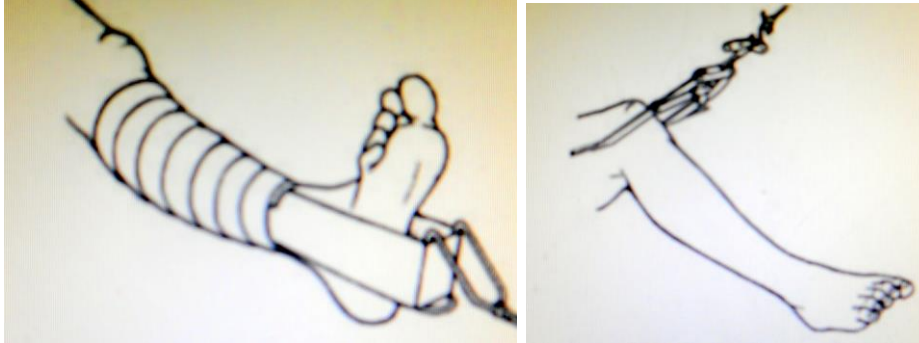
Manual traction overcame the muscle spasm associated with fractures often with the use of anaesthetics and a plaster cast or splints applied.

Different types of traction were developed using the skin with adhesive tape, skeletal traction with pins (Steinman, Denham) through the bone, to which were attached weights. Crutchfield tongs inserted into the outer table of the skull to attach weights were used to manage neck fractures.



Other doctor's names became associated with these types of traction, such as **Buck's** traction, **Hamilton Russell** traction, **Bryant's** traction.

Various frames attached to the beds were needed, and special nurses or orderlies trained in their application. **Balkan** beams, **Braun** frames were found in hospitals all over the world.



Often a period in traction was used to allow swelling to abate before internal fixation.

Whilst this method of treatment has largely been superseded by internal fixation in first world countries, it is still widely used in most parts of the world.

**Ernest William Hey Groves, 1872-1944**, pioneered the use of short intramedullary bone pegs in the treatment of proximal femoral fractures in 1916. He was the first to replace the head of the femur with an ivory prosthesis for the treatment of arthritis in 1917.

Neurosurgery and Orthopaedics split from general surgery during this time.

**Gerhad Kuntscher, 1900-1972**



During WWII repatriated prisoners of war returning to Britain with fractures of the femur were noted to have long rods inside them, having been treated by Kuntscher's technique.

Improvements in design and materials have been made since, and, indeed, the advancement of surgery has been possible only with the assistance of the firms who manufacture the prostheses now used.

The **AO** (Arbeitsgemeinschaft für Osteosynthesefragen), method of compression fixation of fractures was developed in Switzerland in 1958.

## NEUROSURGERY

**Harvey Cushing, 1869-1939** developed neurosurgery as a separate discipline, after training under William Halstead at Johns Hopkins hospital in America, as well as Europe.



He established the Hunterian laboratory for Animal experimentation.

He was posted to France when America entered WWI in 1917, treating head wounds. He had already developed the silver clip to control bleeding, and post war used diathermy to coagulate blood vessels.

He eventually removed over 2000 brain tumours with less than 10% mortality. He helped in the investigation of the pituitary gland; the so called conductor of the Endocrine orchestra.

## BLOOD TRANSFUSION

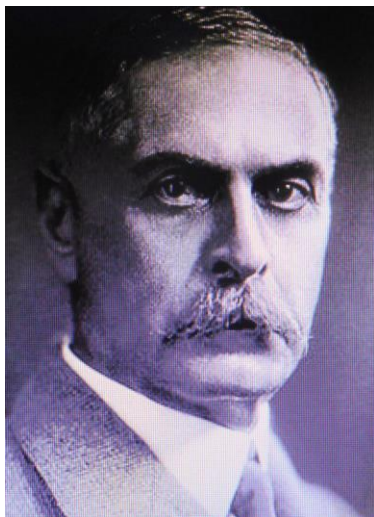
This was first tried in 1628, after William Harvey (p24) demonstrated the circulation of blood, but the results are not known.

In 1665, **Dr Richard Lower, 1631-1391**, was able to transfuse blood from one dog to another to keep them alive.

In 1795 **Dr Philip Syng Physick, 1768-1837**, performed the first human transfusion but did not publish his result.

Various other doctors contributed after then, using milk then saline as a substitute.

**Dr Karl Landsteiner, 1868-1943**, was born in Austria, and studied medicine at the University of Vienna.



In 1900, he discovered the three major blood groups A, B and C (later changed to O). He received the Nobel prize in for this 1930.

Group AB was discovered in 1902 by his colleagues **Alfred Decastello** and **Adriano Sturli, 1873-1962**.

After WWI he moved to the Netherlands.

He, along with others, in 1939/40 found the Rhesus factor which had contributed to many adverse reactions

In 1909, along with **Erwin Popper, 1879-1955**, he discovered the polio virus.



**Dr Oswald Robertson, 1886-1966**, was born in the UK but his parents migrated to America when he was 18 months old. He attended Harvard medical school.



In 1914 long term anti-coagulants such as sodium citrate were developed to allow longer preservation of blood. This was modified to a citrate–glucose solution in 1916 to allow longer storage of blood, and in 1917 he established blood depots during WWI.

He was awarded the AABB Landsteiner award in 1958 as developer of the first blood bank.

## DIABETES MELLITUS



This disorder, had been known throughout history, but although experiments in 1889 with dogs whose pancreas had been removed had shown high blood sugar levels, loss of weight and increased thirst, leading to death, the isolation of insulin had to wait.

**Frederick Banting, 1891-1941**, graduated as a doctor from the University of Toronto and served in WWI where he was awarded the Military Cross for bravery. It was known that there were groups of cells in the pancreas known as the “Islets of Langerhans” after **Paul Langerhans, 1847-1888**, who discovered them in 1869.

In 1916 a British researcher, **Edward Sharpey-Schäfer, 1850-1935** found these islets remained after the pancreatic duct was tied off, and he reasoned that they may secrete a hormone responsible for regulating blood sugar, which he named Insuline, although he did not extract it. He was also the man who named the ductless glands **Endocrine glands**, which secrete directly into the bloodstream.

A paper by an American pathologist **Moses Barron**, had noted that an autopsy of a patient, who had died with an obstructed pancreatic duct, had intact islets, even though the pancreas was shrivelled, and that the patient did not have diabetes.

Banting, post war, was working as a part-time teacher and demonstrator in surgery and anatomy at the University of Western Ontario.

He read Barron's paper in 1920 when he was preparing a lecture on carbohydrate metabolism and decided to investigate it.

He approached **John Macleod, 1876-1935**, chairman of the Physiology department at the University of Toronto and was granted laboratory space even though Macleod doubted the result.

He had a young graduate assistant **Charles Best, 1899-1978**, to help, (left in the picture).

They were given the services of **James Collip, 1892-1965**, a biochemist and did succeed in isolating Insulin.



In January 1922 they were asked to treat a 14 year old boy dying of diabetes and he improved dramatically. Banting and Best published a paper in 1922: "The Effect Produced on Diabetes by extracts of the Pancreas"

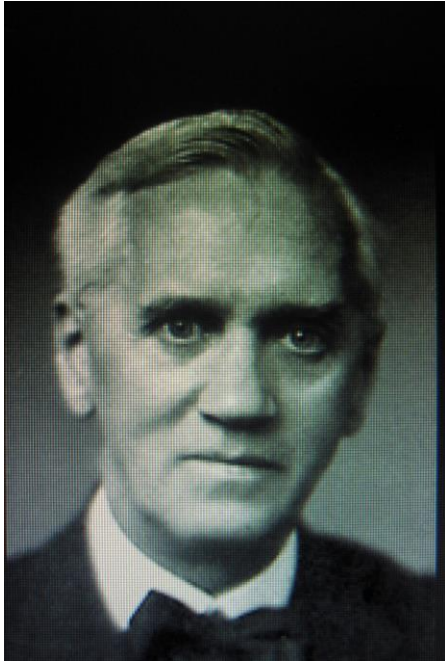
Macleod wanted to share the discovery, and indeed was given a Noble Prize in 1923, which caused Banting to fly into a rage. Macleod gave part of his portion of the award to Collip, and Banting a share to Best.

Banting was killed in WWII when he was serving as a major in the Army Medical Corps, and the plane in which he was flying between Canada and England, went down at Gander, Newfoundland in 1941. The lake into which the plane crashed is now known as Banting Lake.



## PENICILLIN AND ANTIBIOTICS

**Sir Alexander Fleming 1881-1955**, was a Scottish bacteriologist who worked at



St Mary's hospital in London. In 1928 he had left a Petri dish (a flat plate like dish with a film of agar jelly, used to grow colonies of bacteria), on a ledge in his laboratory one weekend, and when he returned he noted that colonies of staphylococcus, a common bacteria, had grown, but there were also filaments of blue mould, similar to that found when food is left too long in the fridge, and at the base of these filaments the bacteria had not grown. This mould was *Penicillium notatum*. He did not pursue this phenomenon but published an article about it in the British Journal of Experimental Pathology in 1929.

In the meantime, **Howard Florey, 1898-1968**, an Australian doctor had come to England as a Rhodes scholar, and was working as an experimental pathologist, before being appointed as head of the Dunn school of pathology at Oxford university in 1935. He was trying to extract lysozyme, an enzyme, but failed.



**Sir Ernst Boris Chain**

He hired **Boris Chain, 1906-1979**, who had fled Nazi Germany in 1936. He was a brilliant biochemist, and he succeeded.

Chain went through 200 articles and found Fleming's paper on penicillin. Together they focussed their attention on this mould in 1938 and, with the help of **Norman Heatley, 1911-2004**, who contributed to the extraction process, they were able to extract a stable product.



**The Lord Florey of Adelaide**

WWII broke out in 1939, but in 1940 they were able to observe the success in mice treated with penicillin after a lethal dose of Streptococci.

In February 1941, a policeman made a dramatic recovery after being near death from an infection, but died when the supplies of the extract ran out. British companies were unable to help due to the war, and Florey went to America in June 1941, (America did not enter the war until December 1941 after Pearl Harbour) and received support from the Department of Agriculture. **Andrew J Moyer** found that corn steep liquor, a waste product of corn could be used to greatly increase the production of penicillin. Clinical trials took place in 1942, proving its lifesaving qualities in severe infections.

In 1945 Fleming, Florey and Chain all received the Nobel Prize, after disputes as to the discovery.

Florey was remembered on the Australian \$50 note, although this has now been replaced. Note the petri dish with the lucency around the white circles of penicillin.



Overuse of penicillin has led to the development of resistant strains of bacteria, and even these are now resistant to more powerful drugs and are known as Golden staph or MRSA (Methicillin Resistant Staphylococcus Aureus).

The discovery of penicillin did lead to the investigation of various other drugs and different antibiotics for different organisms.

It is a constant battle between science and the organisms becoming resistant, through mutation.



## **VIRUSES**

These are different in nature to bacteria, but just as deadly.

Vaccination against viruses has led to the elimination of smallpox with the last case recorded in India in 1977.

**Poliomyelitis** or polio, sometimes called infantile paralysis, is an infection of the motor cells in the spinal cord and leads to paralysis of limbs or even the respiratory muscles. Patients often had to be nursed in an iron lung. Braces for lower limbs were common.

In the 1930s, **Jonas Salk, 1914-1995**, developed a vaccine made from a dead virus, and **Albert Sabin, 1906-1993**, who based his work from Pasteur, a vaccine from a weakened virus. The dispute between the two men ran for years.

By 1961 the Sabin vaccine was deemed the better and between 1995 and 1996, 400 million children had been immunised.

The disease has all but now been eliminated, except in some parts of Pakistan where fundamentalist Muslims are preventing immunisation of children, as it is a product of the West, or the Great Satan.

Today most children are immunised against all manner of once common and fatal diseases, such as diphtheria, whooping cough, typhoid, measles, mumps, rubella, tetanus and polio.

Unfortunately, a few years ago, a now discredited scientist, gave mothers a scare about MMR (measles, mumps, rubella) vaccine causing autism or Aspergers (a form of autism), and they did not get their children immunised. There are now many children contracting measles which can have serious side effects such as meningitis.

## **SMOKING AND LUNG CANCER**

The first world war WWI saw an enormous number of men, and, after it ended, women, who accepted smoking as not harmful to them, although many developed emphysema, shortness of breath and lung cancer.

Studies in the 1950s found the association, but the powerful tobacco companies were able to withhold data until even they had to admit to the scientific proof that smoking was harmful to health.

Since most people (and governments) in developed countries have accepted the science, the tobacco companies have targeted the poorer nations.

The only benefit now, is to the governments, which impose large taxes on packets of cigarettes.

## HEART DISEASE.

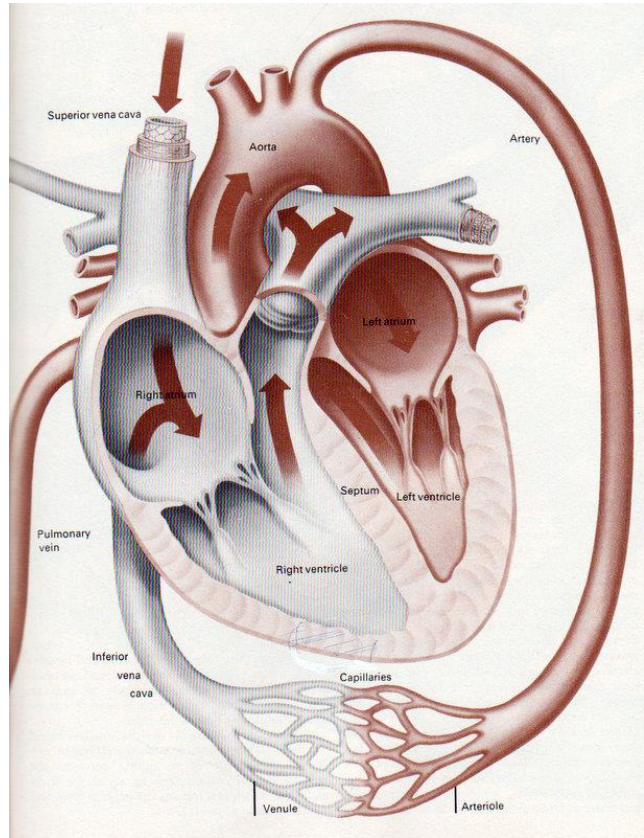
The **stethoscope** (page 23) and **sphygmomanometer** helped doctors diagnose many heart problems.

The heart is a muscle which has to pump the blood around the body and through the lungs for re-oxygenation. There are two parts, separated by a muscular septum and each has a receiving chamber called the atrium and a discharging ventricle which acts as the main pump. They contract synchronously.

The right half receives the de-oxygenated venous blood and pumps it to the lungs and the pulmonary veins bring the now oxygenated blood to the left half which pumps it around the body.

The flow is controlled by valves which are closed forcibly, and these are the sounds heard through the stethoscope and in a normal heart sound like Lub, Dupp. When valves are diseased the flow changes and a murmur can be heard like a soft sshhh.

The rate is controlled by a nerve supply and also by hormones such as adrenaline.



The **sphygmomanometer** was developed by **Samuel Karl Ritter von Basch, 1837-1905**, in **1881** and modified by **Scipione Riva-Rocci, 1863-1937** in **1896**. Harvey Cushing brought that version to America in 1901 where it was modified and came into general use.

**Nikolai Korotkov, 1874-1920**, heard sounds which were the diastolic pressure.

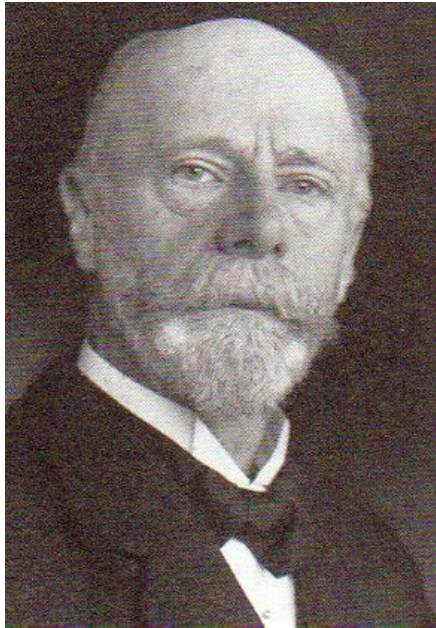
A cuff was placed around a patient's arm and inflated, with a column of mercury measuring the pressure, with a stethoscope over the brachial artery at the elbow.

As the cuff deflated the heart sound could be heard, which then faded. The higher sound was the systolic pressure as the heart pumped out the blood, and the diastolic as it relaxed.

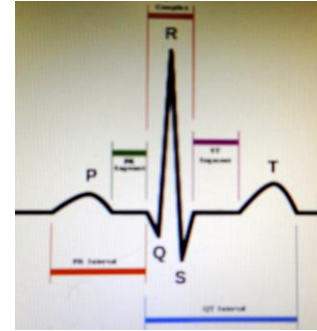
High blood pressure (normal 140/ 80 mm Mercury) places extra load on the heart muscle and can lead to overload causing angina (chest pain) or a heart attack.



**William Einthoven 1860-1927**, in Leiden, the Netherlands in **1901** developed the **electrocardiograph (ECG)**, measuring the electric impulses from the nerve supply to the heart. The machine has been upgraded many times since.

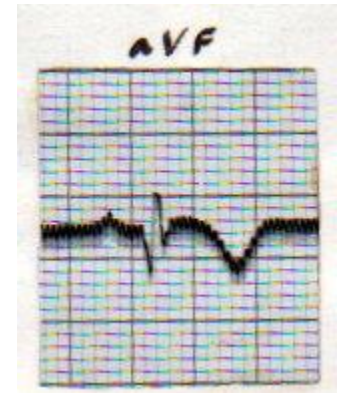


Electrodes are fixed to the chest wall and limbs and measure the nerve impulses controlling the contractions of the heart, on a rotating drum or paper roll, nowadays recorded on oscilloscopes.

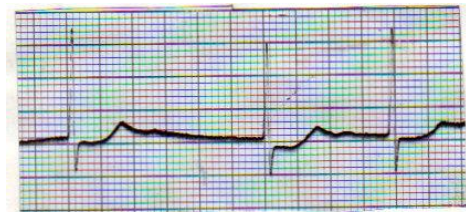
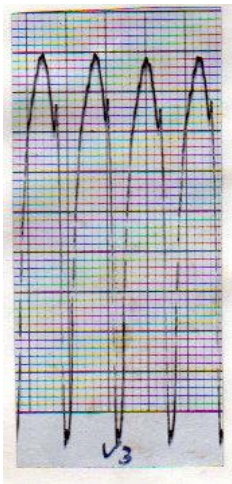


The P wave is the contraction of the atrium, the QRS is the continuation of the impulse and the T wave the ventricular depolarisation.

Changes in the complex can indicate an infarct (heart attack) (note the inversion of the T wave),



and differences in rhythm, such as ventricular tachycardia, extra systoles, or atrial fibrillation (absent p waves, irregular beat).



The heart itself, needs a blood supply and this is from the coronary arteries.

Because arteries are under pressure their walls are thick, whereas veins are low pressure and can be easily compressed, with internal valves directing flow.



Damage to these valves and the hydrostatic pressure leads to **varicose veins**.

They were recognised back in the time of Hippocrates and even appeared on statues!

Both veins and arteries are lined with a smooth layer of cells on which can be deposited a layer of fat (cholesterol) that can gradually block the flow, leading to the symptoms of angina or more severe pain in a full blown heart attack, even death, when the heart stops beating.

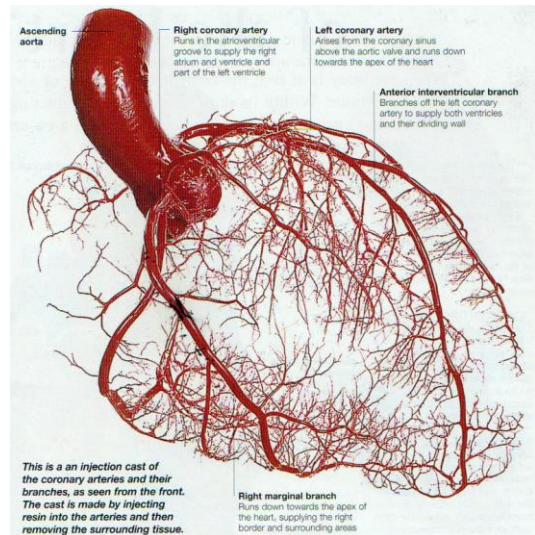
Various drugs have been developed to lower blood pressure and others (statins) to lower cholesterol.

These have been developed by animal experiments, before human trials and tested by double blind studies.

**Dr Daniel Hale Williams 1856-1931**, performed the first open heart surgery in 1893, when he repaired a wound to the heart, by opening the pericardium (a thick fibrous sac surrounding the heart), and repairing the muscle and lining of the heart.



The valves in the heart can become diseased and fail, but surgery was not really possible until the development of the heart lung machine, which revolutionised surgery, leading to valve replacement, coronary bypass grafting and, ultimately, to replacement of the heart itself.





It was not until the discovery of heparin in 1916 which prevented blood clotting, and which was reversible with Vitamin K, that development was feasible.

The first successful machine was made in 1952 and the first open heart operation, using a machine, was performed by **Dr John Gibbon 1903-1973**, in May 1953.

This machine was further developed at the **Mayo Clinic** in Rochester Minnesota, in the mid-1950s. It is also known as the Cardio-Pulmonary Bypass (CPB) machine.

**Dr Willam Worrall Mayo, 1819-1911**, founded the Mayo clinic in 1883. A tornado had struck Rochester killing 37 and injuring 200. One third of the town was destroyed. A temporary hospital was established and he and his son **William James, 1861-1939**, also a doctor, as well as other doctors all treated the injured. His other son **Charles Horace, 1865-1939**, followed him in medicine and they established the Hospital which became known as the Mayo Clinic.



It has grown into one of the largest non-profit and research groups in America employing 4500 physicians and scientists, 57100 allied staff and spending \$660 million per annum on research.

Investigation by coronary arteriography when radio-opaque dye was injected into the vessels showed which and where they were blocked. This led to coronary artery bypass grafting (CABG), taking a vein, from the leg usually, joining it to the aorta and implanting it into the heart to restore blood supply.

Balloon angioplasty and insertion of stents soon followed.

A team led by **Dr Robert Goetz, 1910-2000**, and **Dr Michael Rohman**, carried out the first bypass in May 1960, using a cardio-pulmonary bypass machine, also known as a heart-lung machine.

**Dr Christiaan Barnard 1922-2001**, was the first surgeon to perform a human to human heart transplant in 1967.

His patient, Louis Washkansky died after 18 days from pneumonia due to depression of his immune system from drugs used to counteract rejection of the heart.

It created intense controversy at the time as the heart and soul were intermixed according to some theologians.



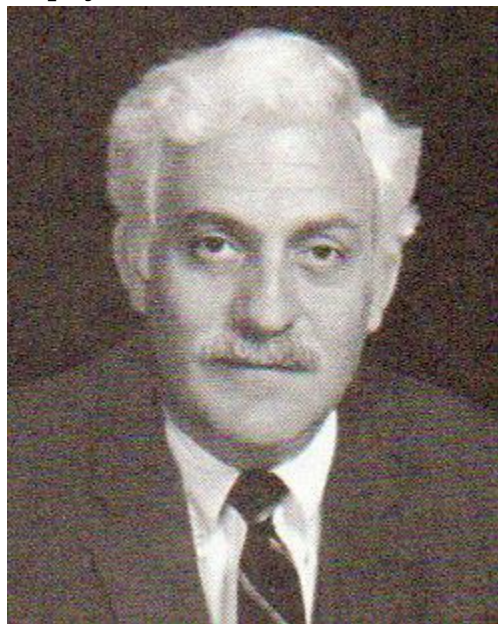
## INVESTIGATIONS AND DIAGNOSIS

When a patient consults a doctor, they have **symptoms** such as feeling unwell, or a pain in their abdomen, for example. A doctor then examines the person, **signs**, and whilst doing so, thinks about what could be wrong, which is a **diagnosis**.

If this is in doubt, further **tests** are undertaken, such as blood tests, examining the urine or sputum, taking x-rays or more sophisticated aids such as computerised tomography (CT), magnetic resonance imaging (MRI) ultrasound scans, radioactive isotope scans, nerve conduction studies, and arteriography, all of which have been developed over the past 100 years, largely thanks to physics.

**Treatment** is then based on the diagnosis and this also has changed considerably. Some operations are no longer necessary or fashionable. Chemistry and microbiology have led to new drugs and antibiotics. Computer technology has proved invaluable.

**Raymond Damadian 1936-**, was a doctor also interested in chemistry and biophysics. He was fascinated as to why Sodium ions stayed outside cells whereas



Potassium mainly remained inside, the so called sodium pump. He realised that there was an ionic attraction and he became familiar with nuclear magnetic resonance (NMR) where nuclei react to a magnetic field similar to a compass needle. The degree of reaction can be measured to analyse compounds. Cancer cells for example reacted differently to normal cells. He published his first paper in 1971 on “Tumour detection by NMR” in mice.

The problem was building a machine big enough for humans, but one was completed in 1977, abbreviated as MRI, Magnetic Resonance Imaging.

Further technological advances have been made in all fields, with automated blood analysis, better MRI machines, Pet CT scanning, three and even four dimensional ultrasonography, thermography, electroencephalography, and peri-operative imaging when inserting cardiac stents. Robotic surgery is being developed.



## **CYSTOSCOPY, ARTHROSCOPY, LAPAROSCOPY, ENDOSCOPY.**

These all mean looking inside something such as the bladder, joints, the abdomen or the gut.

Bladder stones were very common in the 18<sup>th</sup> century and they were removed surgically by skilled surgeons operating through the perineum and feeling for the stone by a gorget passed up the urethra, before incising and removing it by a clamp, often in less than two minutes. Remember, there was no anaesthesia then.

It was not until light bulbs were invented and then miniaturised that one could see inside the bladder.

**Max Nitze 1846-1906** was the first to use one in 1878. In 1888 he wrote: *...this writing only presents a framework, the complete construction of which will be accomplished over the course of years through the joint work of numerous researchers. We are dealing here with a large new field of work which assuredly harbour untold treasures of knowledge.*

**Kenji Takagi 1888-1963**, was the first to use cystoscopes to inspect the interior of the knee in 1920, but technical problems delayed the later success.

Today, surgeons are able to reconstruct ligaments, remove menisci and even repair them, as well as establishing difficult diagnoses, such as gouty deposits within a knee.

Improvements followed, especially in fibre-optics from 1959 onwards, which incorporated flexibility, as well as brilliant illumination, and the ability to take photographs and videos.

Today, endoscopes explore the whole gastro-intestinal tract, the bladder and ureter, the trachea and bronchial tree in the lungs, the smallest joints such as the wrist, as well as the shoulder, hip and knee.

Specialised training is necessary, and the co-operation between the trade and the surgeon has been vital to success.

## JOINT REPLACEMENT

A moving joint is where the bone ends are lined by cartilage, a smooth slippery surface, lubricated by the fluid secreted by the lining membrane of the joint.

Because cartilage is a tissue which cannot regenerate it wears out especially in the weight bearing joints of the hip and knee.

It is commonly called arthritis, but more properly should be termed **arthrosis** as this defines degeneration as opposed to inflammation. The joints become painful and stiff.

Other joints can be affected, often after trauma.

Rheumatoid arthritis affects almost every joint, and is properly called arthritis, as it is an inflammatory disease.

Orthopaedic surgeons have been aided considerably by their colleagues in the design and manufacture of implants. These have steadily improved as new materials emerge and new methods of manufacture replace obsolete.

### Hip Joint

Various operations have been devised with **Hey Groves, 1872-1944**, replacing the head of the femur with an ivory prosthesis in 1917.

**Robert Judet, 1909-1980**, in France used Acrylic instead of ivory with a similar design in 1946.

**Marius Smith Petersen, 1886-1953**, used a Metal cup to place over the head.

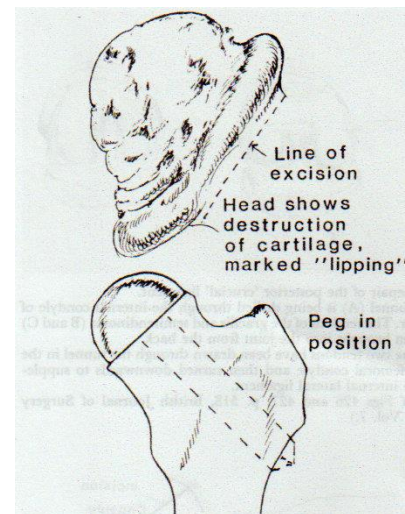
**Austin Moore, 1899-1963**, used a stem prosthesis with perforation for bone ingrowth, in the stem with a metal head. **Frederick Thompson, 1907-1983**, used a similar prosthesis, but with a solid stem

**McKee-Farrar**, and **Ring** both used a prosthesis replacing the ball and the socket. These were metal on metal replacements.

More recently, (since the 1990s) the **Birmingham hip**, developed by **Derek McMinn**, also using metal on metal with a similar design to the Judet but replacing both head of femur and socket has been used, as the surfaces are better machined, but high levels of cobalt and chromium (components of the steel) have been found in the blood. The long-term effects are as yet unknown.

Although there was some success with all of these, none stood the test of time.

Ceramic has also been tried, and is still used, as a smooth articulating material, both in the ball and the socket.





**Sir John Charnley 1911-1982**, also replaced the ball and socket but used a metal ball and plastic socket. The plastic he used initially was of poor quality, until high density polyethylene (HDP) was found.



Methylmethacrylate cement was used in 1958 for fixation of the components (seen as white around the components). The HDP (lucent) cup became the norm, as it did not wear.

The metal ball and stem (white in the x-ray shown)

were smaller than the head of the femur being replaced, to allow thicker HDP and a slightly more central position of the head.



He established a rigid procedure for inserting the hips of his design and many surgeons travelled to Wrightington, UK, to learn his technique.

## **Knee Replacement**

This has followed a similar course but the initial hinges failed, as there is a degree of rotation in the joint, and it was not until this was recognised that prostheses became more successful.

## **Shoulder, Elbow, Wrist, Knuckle, Ankle and even teeth replacement**

Prostheses are available and used when indicated

## **Spine disc replacement**

Although currently being used, no long-term results are available

## DIALYSIS AND ORGAN REPLACEMENT

Kidney failure leads to death and no treatment was possible until **Dr Willem Kolff, 1911-2009**, a Dutch physician, developed a machine using sausage skins and other components in 1943. However, it needed **Dr Belding Hibberd Scribner, 1921-2003**, in 1960, to invent a Teflon shunt enabling the machine to be used repeatedly without damaging blood vessels.

**Dr Yury Vorony** in USSR in 1933, transplanted a kidney from a deceased donor to a patient's thigh and was able to measure kidney function for 2 days, until it was rejected as it was incompatible.

The first between living donors and recipients took place in Paris in 1952, by **Dr Jean Hamburger, 1909-1992**, but the kidney failed after three weeks.

Immuno-suppression was still to be successful.

**Dr Joseph Murray, 1919-2012**, carried out the first successful living transplant in 1954, between identical twins Richard and Ronald Herrick. Richard lived for eight years.



The photo shows him demonstrating to the twins what was called an “artificial kidney”.

Murray went on to investigate drugs to suppress the immune rejection, when non identical donors were found.

Prednisolone (a corticosteroid), azathioprine and cyclosporine

were found to be effective, but also carried negative side effects and made the body more susceptible to infection.

**These drugs enabled other organ transplants such as the heart, lung, heart-lung combined, liver, and even the hand (1998) to be carried out from the 1960s onwards.**



## PSYCHOLOGY AND PSYCHIATRY

**Sigmund Freud, 1856-1939**, developed psychoanalysis by listening to his patients, often with them relaxing on a couch. He postulated that repressed sexual fantasies played on their minds. Patients, often after several sessions, found their own solutions to their problems.

**Carl Jung, 1875-1961**, was initially closely associated with Freud but gradually developed his own theories of analytical psychology.

**Alfred Adler, 1870-1937**, was another psychiatrist, also involved with Freud's theories and also gradually developed his own ideas.



**Electroconvulsive therapy (ECT)** was tried by **Ugo Cerletti, 1877-1963**, and **Lucio Bini, 1908-1964**, in Italy in 1938, for relief of depression, but the seizures induced often led to patients breaking their own bones. Anaesthesia helped, but it is rarely used today.

**Frontal lobotomy**, cutting the neural pathways in the front of the brain was extensively used in the 1940s and 1950s, but although it seemed to help some people, others were disabled. It fell into disuse when anti-psychotic drugs such as chlorpromazine were developed, although even these had side effects.

**Lunatic asylums** were changed to **mental hospitals**, as it was felt that this name change carried less stigma. Gradually, as better and better understanding and methods of treatment were developed treatment in the community became the norm.

## EYESIGHT, CATARACTS AND GLASSES.

Binocular vision is something we all take for granted, until we find our arms are too short to read, and we are then prescribed glasses which have been developed and used for centuries. Contact lenses have been developed, and surgery to weaken the lens is used in some cases.

Cataracts or clouding of the lens, leading to blindness, is corrected by excision of the lens and implantation of a plastic lens after excision. **Fred Hollows, 1929-1993**, made a significant contribution to the Australian aboriginal community through the treatment of trachoma and cataract surgery.

He inspired others to continue his work world wide.

## DENTAL DECAY AND THE HIGH SPEED DRILL

Caries or tooth decay has always been common and most teeth were treated by extraction. Sometimes, after extraction, these were replaced, (see John Hunter page 24), or the holes in the teeth filled with gold. Drilling into teeth has been observed in stone age men. The holes created cut away the decay. Early drills spun by cords, were developed by **Pierre Fauchard, 1678-1761**.

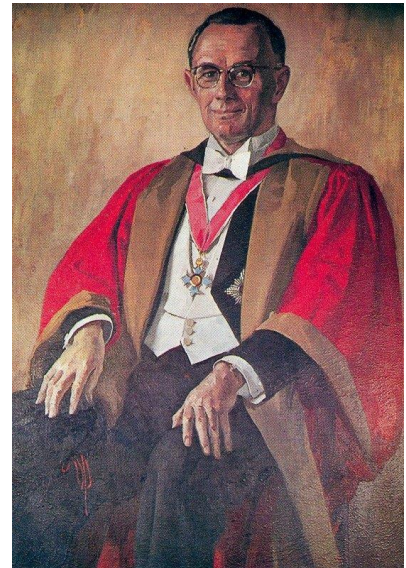
Later foot pedal operated ones became available when **James Beall Morrison, 1829-1917**, patented one. Motorised drills became available with speeds up to 2000 revolutions per minute. It was most unpleasant and people hated going to the dentist. An amalgam made of tin and mercury was used to fill the holes, or gold.

The Nazis in the death camps in Europe in the Second World War used to use the Sonderkommando to extract the teeth from Jews killed in the gas chambers, before committing them to the ovens. Millions met their fate in Auschwitz, and the gold extracted was melted into bars and stamped with the SS insignia. Some of these bars were later recovered from the salt mines, after the war ended, where The Nazis had hidden the art treasures plundered from occupied territories

In 1946, my father, **Sir John Walsh, 1911-2003**, who had served in the Royal Australian Airforce as a facio-maxillary surgeon during the war, was testing vibration sense in the teeth of servicemen being discharged by using two tuning forks. One, a middle C, vibrated about the same frequency as the dental drill and felt unpleasant, and the other, a high C, although audible (bone conducts sound) produced no vibration. He thought about how to translate a horizontal frequency into a rotational frequency.

He was appointed as Dean of the Dental school in Dunedin, New Zealand and worked with the engineering department to produce a high speed drill.

He succeeded in 1949, with speeds of 60,000 revolutions per second. The NZ government took out a patent, but not a world patent, and he shared the idea with colleagues in America and UK when he travelled there to study Dental education. The Americans produced commercial models in the 1960s, and now speeds have increased to over 400,000 revolutions per minute. He improved Dental education and a new Dental school was opened in 1956. He was honoured by a knighthood in 1960 for contributions to Dentistry, and the Dental school named after him in 2001.





Amalgam fillings have largely been replaced by rapidly setting durable polymers which can be coloured to match the teeth. Bridges are made with natural looking teeth. Children are now using braces that are virtually invisible to correct crooked teeth.

### **Obesity and dental decay.**

Today there is an epidemic of obesity, with extra sugar consumption in foodstuffs, especially drinks such as coca-cola and other fizzy drinks. McDonalds have sugar in their buns!

The food industry is behaving like the tobacco industry in the 60s, by denying it is to blame.

Children are being given fruit juice which can contain as many as 5 teaspoons of sugar per pop straw box of 250 ml. Cornflakes, rice bubbles and other breakfast cereals all have added sugar. Dental caries (tooth decay) is rising in tune with obesity.

Anti-fluoridationists are again on the rampage, in spite of proof that it hardens enamel and reduces decay.

This was initially found in 1901, by **Frederick McKay, 1874-1959**, a dentist in Colorado Springs, that there was an almost absence of decay in patients with spots on their teeth and it was related (after years of research) to the presence of naturally occurring fluoride in the water. In 1945, in Grand Rapids Michigan, introduction of fluoride to the water also reduced decay. It became US policy in 1951.

Fluoride is now incorporated in toothpaste.

## **HEARING AIDS AND COCHLEA IMPLANTS**

**Ludwig van Beethoven, 1770-1827**, was renowned for his deafness and his use of an ear trumpet before he lost his hearing altogether. The invention of the telephone and microphone, led to early aids using the technology.

As with everything, in the 20th century inventions proceeded apace, with transistors, then computers and microprocessors which led to the Digital processing Chip (DSP) in 1987. Behind the ear aids were made and further refined. Connection via blue tooth and mobile telephones enabled wearers to hear conversations through their aids and talk to a microphone around their neck. Profoundly deaf people are now being trialled with direct stimulation of the cochlear nerve with an electronic device that bypasses the outer and middle ear. It involves an operation to insert the device and the filament.

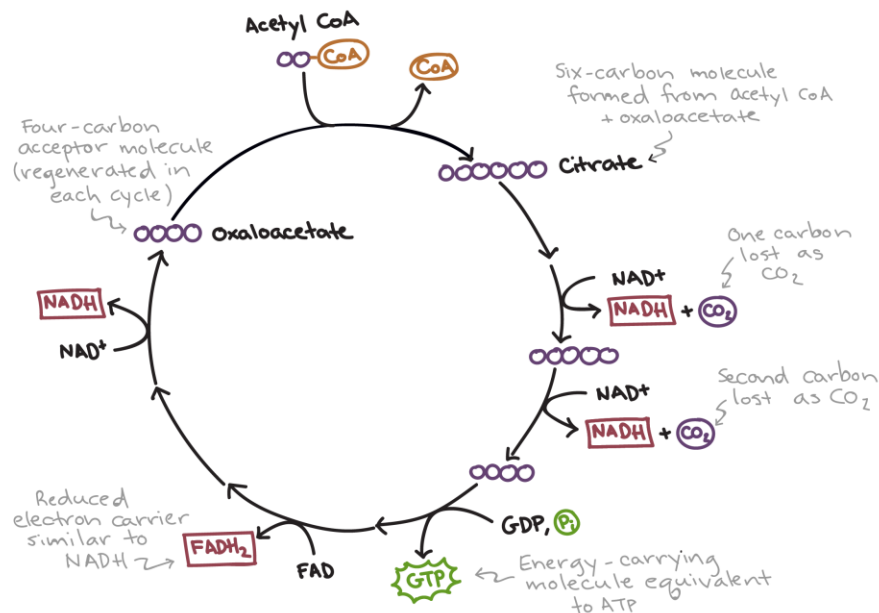


## BIOCHEMISTRY AND THE CITRIC ACID OR KREBS CYCLE



**Sir Hans Adolf Krebs, 1900-1981**, was born in Germany and educated there becoming a doctor in 1925, but then turned his attention to research. He discovered the metabolism of urea with **Kurt Henseleit, 1908-1973**, in 1930, known as the Krebs-Henseleit cycle or ornithine cycle. He lost his position as a well-regarded scientist; when Hitler came to power. In 1933 he moved to UK because of his Jewish ancestry, and was naturalised in 1939.

In 1935 he was offered a post as Lecturer in Pharmacology at the University of Sheffield where he remained for 19 years. Whilst there, he and **William Johnson, 1913-?** who was studying for his PhD, studied cellular respiration and the metabolism of glucose. In 1937 they had worked out the various reactions in which cells utilise oxygen to produce energy and release  $\text{CO}_2$ . They called it the citric acid cycle. He refined the mechanism further when **Fritz Albert Lipmann, 1899-1986**, discovered acetyl-co enzyme A in 1947. He shared the Nobel prize in 1953 with Krebs. This mechanism is common to all cells.



In fact, apart from the world war years a Nobel Prize was given each year in the twentieth century, but it has been difficult to include everyone in this book.



## CHAPTER 8 THE TWENTYFIRST CENTURY

### STEM CELL TECHNOLOGY

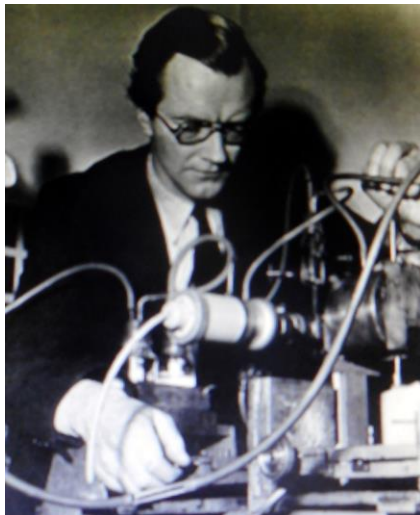
Genetics has been around almost as long as humans have cultivated animals and grown their own food. The science behind why cross breeding resulted in bigger and better animals was studied by **Gregor Mendel 1822-1884**, an Austrian monk who had already studied physics, but in 1854 began to study hereditary traits in plants and chose peas due to their distinct varieties. He found, dominant and recessive characteristics, in 1865, after studying more than 20,000 pea plants, and applied this to all living things. These traits are now called **genes**.



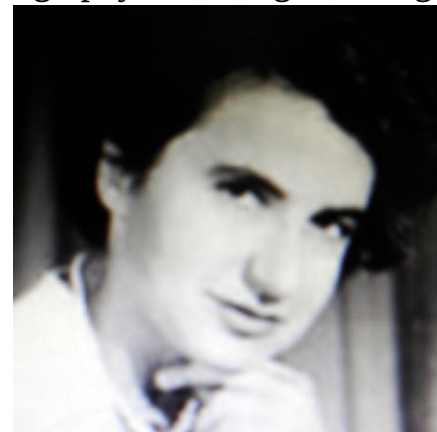
The fact that matter grew from cells had been postulated by **Rudolf Virchow 1821-1902**, who had found cell division under the lens of his microscope. These threadlike structures were **chromosomes**, first identified in 1902 by **Theodor Boveri 1862-1915** and independently by **Walter Sutton 1877-1916**.

Chromosomes consist of coils of **DNA** (deoxyribonucleic acid).

**Maurice Wilkins 1916-2004**, was a New Zealand born British physicist, who worked on Radar for the first part of the war, and later the Manhattan project building the atomic bomb. He was horrified by the bomb, and returned to the UK studying x-ray crystallography at Kings College, London.



At the same time **Rosalind Franklin 1920-1958**, who had graduated in Physics and Chemistry from Cambridge university, joined his unit at



Kings college and built a better machine. She was able to photograph crystallised DNA fibres, and postulated a helical structure, which she presented at a lecture in Kings College at which **James Watson** was in attendance, although he later admitted to not paying much attention, even though he was studying the structure of DNA with Francis Crick. In 1953 she, and Watson and Crick published their findings in “Nature”

**Francis Crick 1916-2004, and James Watson 1928-**, both molecular biologists,



worked together at the Cavendish laboratory in Cambridge in 1953, to try to unravel the structure of DNA.

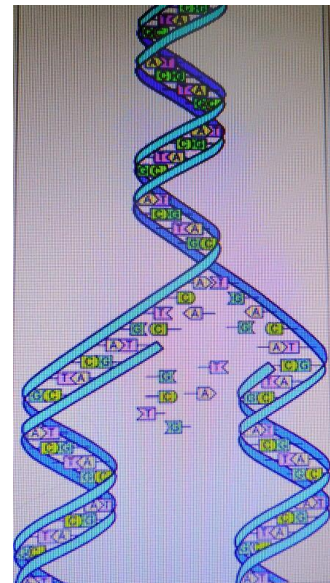
They were helped by Maurice Wilkins, who showed them the work of Rosalind Franklin.

They built a 3d model showing the double helix of poly-nucleotide chains. Each nucleotide is a compound of a sugar molecule (deoxyribose) and a phosphate molecule which Franklin had shown to be on the outer side of the helix.

The links of amino acids of **adenine** and **guanine** on one side are paired with **thymine** and **cytosine** on the other. At nuclear division each strand separates and the pairs with another. The primary action of a gene is to make proteins by different combinations, stored within the DNA molecule.

Genetic information is thus passed to each daughter cell.

RNA (ribonucleic acid) which has a similar structure to DNA helps in this transmission as messenger RNA



They all received the Nobel prize in 1962, except Rosalind Franklin who had died of cancer four years before.

The Nobel committee does not award posthumous awards.



**The Human Genome Project**, to decipher the three billion nucleotide base pairs, was launched in 1990 as an international effort and was finally deciphered in 2003.

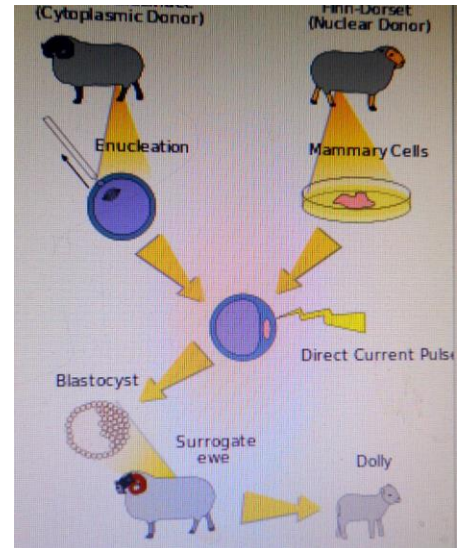
It has opened the door to the causes of different diseases, the identification of criminals as each person (other than identical twins) has a specific structure of DNA

### Cloning of animals



Possibly the most famous sheep of all time is **Dolly**, 1996-2003.

An egg was taken from one sheep, and the nucleus extracted.



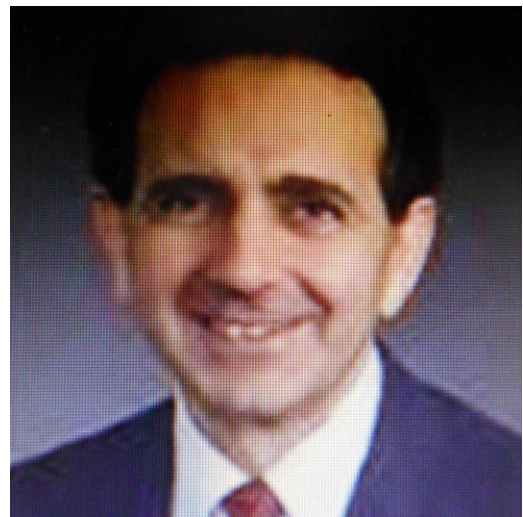
The nucleus (containing the DNA of that sheep) from another sheep, was then inserted into this enucleated cell and after cell division stimulated with an electric charge was then implanted into the uterus of another sheep to bring the embryo to term.

Dolly was able to breed and produced six lambs in total. She died of a form of lung cancer in sheep at 6 years with a normal life expectancy of 14. However 4 identical clones of Dolly were still alive at 9 years from 2007.

### Stem Cells

These experiments have shown that the information to make all tissues is contained within the cell nucleus. Some adult cells have this ability and it is possible to grow different organs.

**Dr Anthony Atala, 1958-**, Director of the Wake Forest Institute for regenerative medicine, North Carolina, in 2006 created a laboratory grown bladder and transplanted it into a child.



## Human Cloning

Although this is possible it has created intense ethical and moral discussion.

The Nazis, particularly Dr Josef Mengele , known as the Angel of Death, in Auschwitz, performed many experiments during World War II, and these have been condemned by the medical fraternity, due to the manner and types of experiments he did. No results are accepted. Some Jews have survived, such as **Eva Moses Kor** who has said that forgiveness is the best revenge.

The debate is not yet over in regards to human cloning but stem cell technology is becoming accepted.

## LAPAROSCOPIC and ROBOTIC SURGERY.

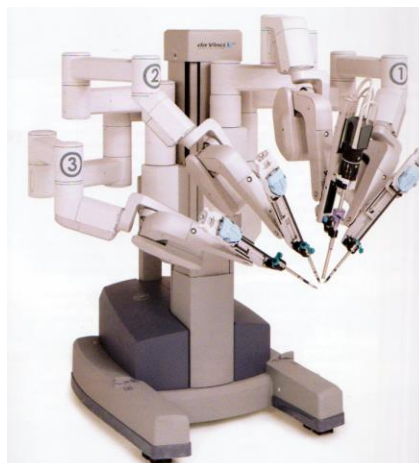
The development of flexible ‘scopes and improved instrumentation have enabled surgeons to perform more and more procedures through small incisions and is often called keyhole surgery. This has led to fewer complications and shorter stays in hospital.

It was first carried out in 1981 when **Dr Kurt Demm, 1927-2003**, a German surgeon, performed an appendicectomy.

**Dr Erich Muhe, 1938-2005**, another German in 1985 and in 1987 a French surgeon, **Dr Phillipe Mouret, 1938-2008**, performed a Cholecystectomy (removal of the gall bladder).

A video computer chip was invented in 1986 that enabled magnification and display onto TV screens which brought about widespread use.

**Dr Mani Menon 1948-**, born in India, is an American surgeon who is chairman of



Urology at Henry Ford hospital in Detroit. He pioneered the development of Robotic surgery, where the machine is controlled by a joystick, with the abdomen viewed from within by a laparoscope. He first removed a prostate cancer in 2000, using it.



## CHAPTER 9 THE FUTURE

Since I graduated in 1962, the human population has more than doubled from 3.1 billion to 7.5 billion and is expected to reach 9.3 billion by 2050.

Humans are now living longer and in better health, than ever before, but the cost of caring for the elderly is now rising, especially as the developed countries are lowering their birth rates. Most people live in cities, which also brings problems.

Many problems face this tide of humanity, such as the reliance on clean water, food, energy, clothing, housing, education, transportation, and hopefully, the avoidance of war, as we are all living on the only habitable planet in our solar system.

Rain forests need to be preserved as the lungs of the planet. The oceans need to be cleansed of plastics, which are now entering the food chain.

More awareness of the need to preserve fish stocks for example, and care of the land, such that soils do not blow away in times of drought, through judicious planting.

Improvements in technology and in computers mean that agriculture is now able to produce greater yields with less human input.

All of the previous achievements have been brought about by mankind, and I include women in this term, as I hate to call it personkind to be politically correct.

Future developments will come, from men and women who are interested in science and are prepared to work hard to solve a problem, for example, 3D printing for more comfortable casts or prostheses on which cells are grown, the myo-electric hand, the camera-eye and many others.

The rate of change is unstoppable.

I expect Mars will have been colonised by 2050, or at least the moon, and crops may be grown there and flown back through the refrigerator of space.

We will have adapted to the planet being warmer and the storms generated.

All in all, it will be a life worth living.

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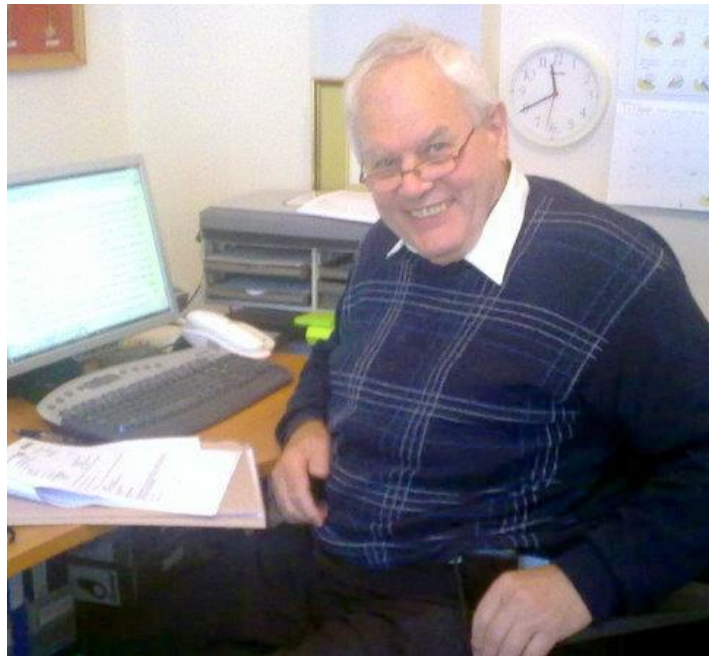
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John Walsh was born in Melbourne, Australia in 1939, and brought up in New Zealand.

He attended Otago University Medical School and underwent initial postgraduate training in General Surgery, Thoracic Surgery and Neurosurgery before continuing training in Orthopaedics.

This included study in the UK and Australia before he entered Consultant practice in Sydney in 1972.



In late 1989, a two year sabbatical was taken to restore a chateau in France, which his wife Hilary ran as an upmarket B & B, while he returned to the UK and NHS in 1992, commuting to France.

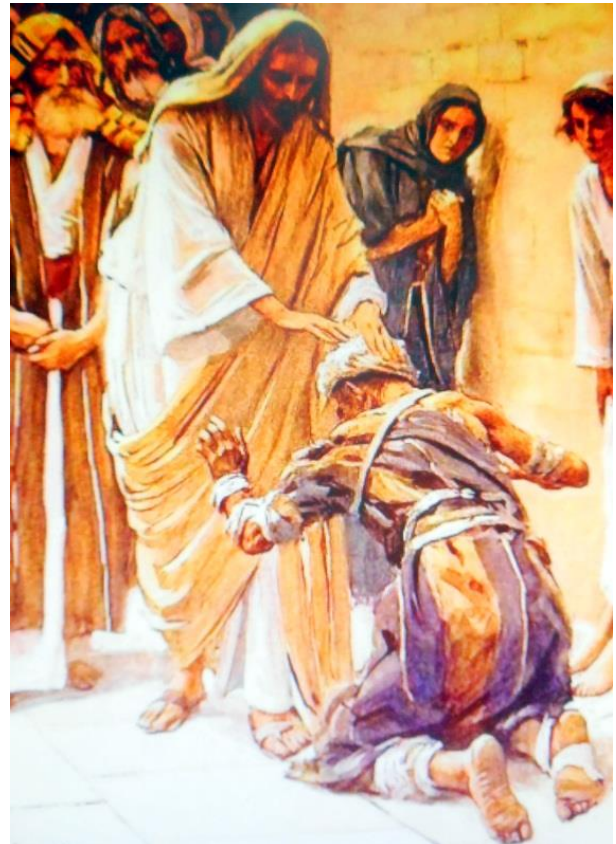
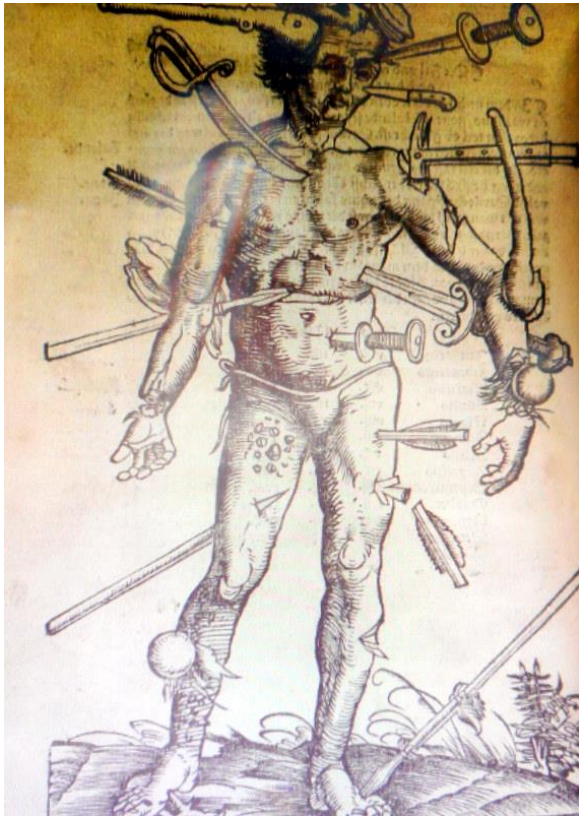
The chateau was sold in 2000.

He and Hilary moved to Windsor UK for 5 years and then Richmond UK for 6 years where he conducted a medico-legal practice in Harley Street, London, and Windsor before returning to Sydney in 2012.

He has been in full time medico-legal practice since 1998, in the UK, and in Australia since 2012.

He now works part-time.

He enjoys reading and has written a book about Orthopaedics, and one about the time he and Hilary lived in France.



\$25.00

ISBN 978-0-646-97316-6



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